PMM

# Precision Metal Molding

NOVEMBER
1956

INCLUDING DIE CASTINGS MAGAZINE

devoted exclusively to:

DIE CASTINGS

INVESTMENT CASTINGS

ERMANENT MOLD CASTINGS

PLASTER MOLD CASTINGS

POWDER METALLURGY

SHELL MOLD CASTINGS

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# MONARCAST* ALUMINUM PERMANENT MOLD CASTINGS OFFER WIDER FINISHING LATITUDE

*Plus*

## MORE CASTING VALUE PER DOLLAR

Product appeal is enhanced, functional value improved, through the wide range of finishes available on Monarcast* aluminum permanent mold castings. These intriguing finishes offer new freedom of design and engineering while simplifying purchasing procedures.

Monarch operates the largest completely owned finishing division in the permanent mold industry. Custom designed automatic equipment speeds mass-production, guarantees uniform quality. End-costs and rejects are lowered through elimination of multiple finishing responsibilities.

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*Casserole:* Sales stimulating Spectraglaze,* colorful porcelain enamel exterior, accented by high polish trim.

*Built-in grill:* High polish Velvaglaze*.

*Waffle baker:* Velvaglaze* highlights product appeal, produces mar and heat resistant cooking surface.

*Electric Fry Pan:* Catches vogue of color-in-the-kitchen with easy-to-clean Spectraglaze* and polished finish.

MONARCH ALUMINUM

* Velvaglaze, Spectraglaze and Monarcast are Trade Marks of

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MANUFACTURERS OF: *Aluminum Permanent Mold Castings • Zinc Die Castings • Aluminum Die Castings • Exclusive Velvaglaze Finishing • and Spectraglaze, colorful Porcelain Enamel on Aluminum Permanent Mold Castings.*

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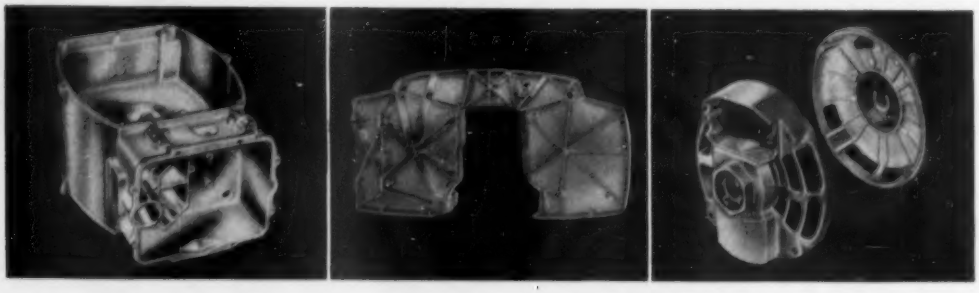
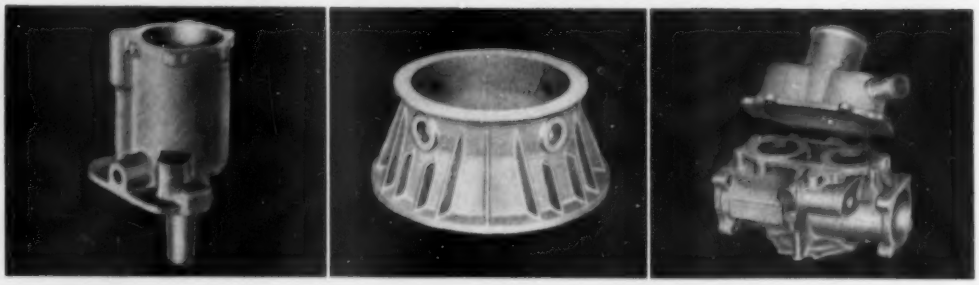
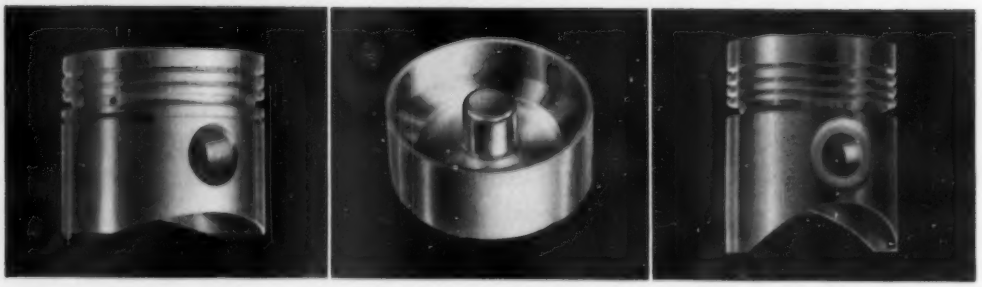
# for die castings



# ...permanent mold castings



# ...impact extrusions



Regardless of your product, if you use castings or impact extrusions, Thompson's experienced and creative engineers can show you where and how to simplify your operations and save on costs. Let us quote now on your plans. Just write, wire or phone Dept. PMM-11, Light Metals Division, Thompson Products, Inc., 2269 Ashland Rd., Cleveland 3, Ohio, HEnderson 1-6765.

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LIGHT METALS DIVISION

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COVER STORY

BUILT-IN MIXERS by NuTone are the newest built-in appliances available for your kitchen. Shown here is Frank A. Knapp, vice president for production (left) discussing some of the die cast parts of the new mixer with Cliff Barnes, general foreman of NuTone's Appliance Division. See page 62.

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Affiliated publications: APPLIED HYDRAULICS, FLOW, INDUSTRY & WELDING, MODERN OFFICE PROCEDURES, OCCUPATIONAL HAZARDS and COMMERCIAL REFRIGERATION AND AIR CONDITIONING. Not responsible for unsolicited editorial material.

Published monthly. Accepted as a controlled circulation publication at St. Joseph, Michigan. Please return Forms 3579 to 812 Huron Rd., Cleveland 15, Ohio

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Prompt delivery

of **DIE CASTING DIE STEELS** from warehouse stocks

...every piece ultrasonically inspected

Crucible warehouses from coast to coast stock over 460 sizes of CSM 2 and NU DIE V die casting die steels—1″ to 40″ wide—¾″ to 15″ thick! And they're all available for *prompt* delivery.

What's more Crucible warehouses are equipped to cut die steels to the size you want. The hacksaw pictured above in one of Crucible's warehouses, for example, is the largest made. It can accurately cut die blocks up to 40″ x 25″.

Huge stocks, plus versatile sawing and handling facilities, mean you get the steel you want *when you want it*. There's no need to wait for delivery from mill or forge shop when you can get *prompt* delivery from Crucible warehouse stock.

But there's more. Ultrasonic inspection of *every* piece of Crucible die casting die steel assures *sound die steel quality* every time. So next time you need die steels, look no further than your nearest Crucible warehouse. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

**CRUCIBLE** first name in special purpose steels

**Crucible Steel Company of America**

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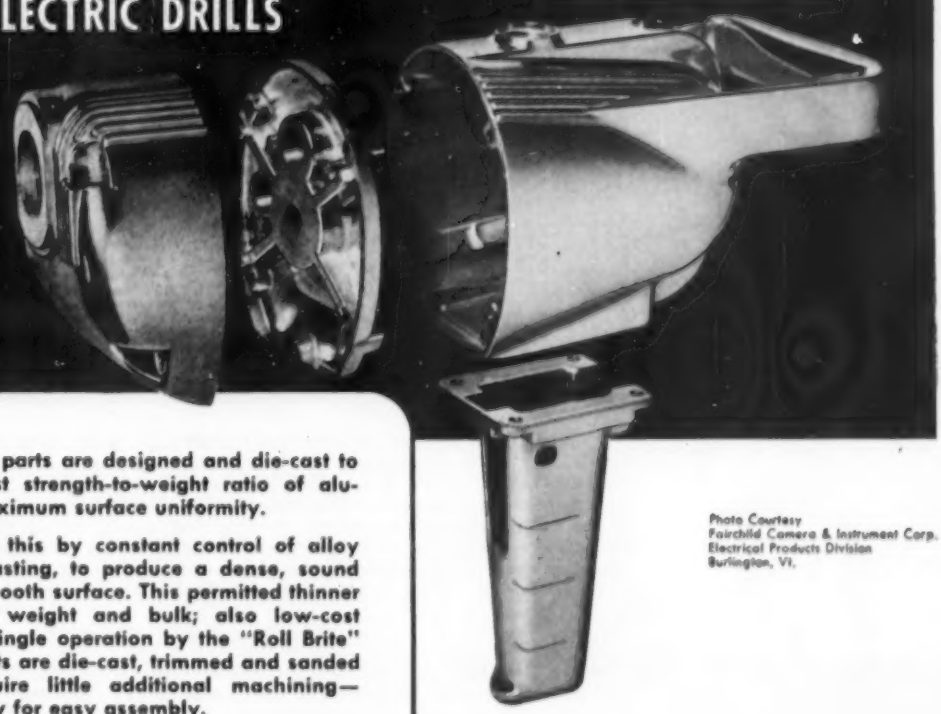
# DOLLIN DIE-CASTINGS

## *meet critical requirements in* FAIRCHILD ½" ELECTRIC DRILLS

- Light weight
- High strength
- Compactness
- Accuracy
- Appearance
- Low cost



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Fairchild Camera & Instrument Corp.
Electrical Products Division
Burlington, Vt.

**These attractive parts are designed and die-cast to gain the highest strength-to-weight ratio of aluminum, plus maximum surface uniformity.**

**Dollin achieved this by constant control of alloy purity during casting, to produce a dense, sound structure and smooth surface. This permitted thinner walls, reducing weight and bulk; also low-cost polishing in a single operation by the "Roll Brite" method. All parts are die-cast, trimmed and sanded by Dollin—require little additional machining—match accurately for easy assembly.**

This is another typical example of Dollin's wide experience and facilities concentrated on producing the best possible die-casting for the job . . . with the biggest possible savings for the customer.

Let us demonstrate Dollin service to you. Submit prints, samples or problems for engineering advice and quotation, without obligation.

**LARGE CASTINGS** Aluminum castings made on large cold chamber type high-pressure machines. Large zinc castings made on large plunger type machines.

**SMALL ZINC CASTINGS** 1000 per lb. to 3 per lb., made on specialized, high-speed, fully automatic machines. Wide design latitude, reduced machining, low piece cost.

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**DOLLIN Zinc and Aluminum DIE-CASTINGS**

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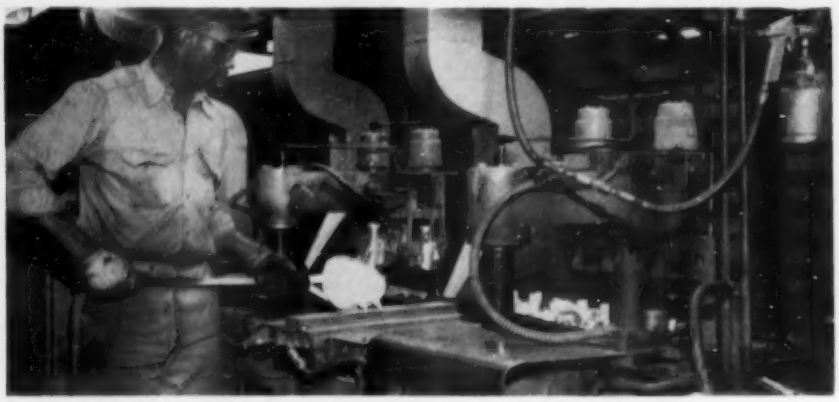
# CASTING ABOUT

*technical news of applications*
*& processes involving precision metal moldings*

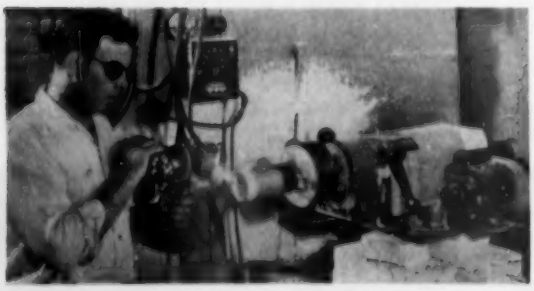
**UP TO 75,000 PISTONS PER DAY** will be cast in the new, modernized aluminum piston foundry just installed at Chrysler Corporation's Highland Park plant. This compares with 52,000 pistons in a 24-hour period previously. The new foundry will supply 75 percent of the expected piston requirements for Plymouth and Dodge V-8 engines, 100 percent of the pistons for Plymouth six cylinder engines and 100 percent of the pistons for the DeSoto and Chrysler V-8 engines.



It will also supply all Dodge truck piston requirements. In the new modernization program which steps up foundry output by 50 percent, 16 automatic casting machines and eight new dry-hearth combination melting and holding furnaces have been installed. This is said to make the Chrysler piston plant one of the largest of its type in the nation. Features of the casting machines: automatic opening and closing on pre-determined cycle, with molds and cores held at controlled temperatures by means of water cooling; steel inserts placed on the cores automatically; automatic ejection. Each of the eight new furnaces has 14 square feet of melting area and can melt 900 lbs. of alumnium per hour.

**INVESTMENT CASTING SALES OF $150 MILLION** are estimated for 1956 by Frank W. Glaser, executive vice president and general manager of Alloy Precision Castings Co., Cleveland. In a recently issued statement, Glaser points out the steady rise of the industry's output . . . from $50 million in 1950 to $125 million in 1955. Castings made by the Mercast process (with frozen mercury patterns) accounted for 10 percent of the 1955 total production, according to Glaser. Alloy Precision is the only foundry in the United States which produces both from wax and mercury patterns.

**PROTECTION FROM ABRASION AND EXCESSIVE HEAT** is provided by a new type of oxide coating applied by metallizing gun. Applications said to be particularly successful include protection of surfaces in rockets, jet engines and guided missiles, as well as a number of commercial applications.



The oxide coatings, developed by the Norton Company and known by the trade name Rokide, can now be applied by means of a specially developed metallizing gun that feeds the rod material at a rate slow and uniform enough to permit the rod to reach proper temperature in an oxy-acetylene flame. The flame reduces the rod to molten particles at temperatures above 5,000 F and the gun projects these at high velocity onto the surface to be coated. Three Rokide coatings are available now: an aluminum oxide coating, a zircon rod which dissociates into zirconium oxide and silica, and a time-stabilized zirconia rod. One standard 24" rod of aluminum oxide ⅛" in diameter will cover about 20 or more sq. inches .010 in six minutes.

*Continued on page 10*



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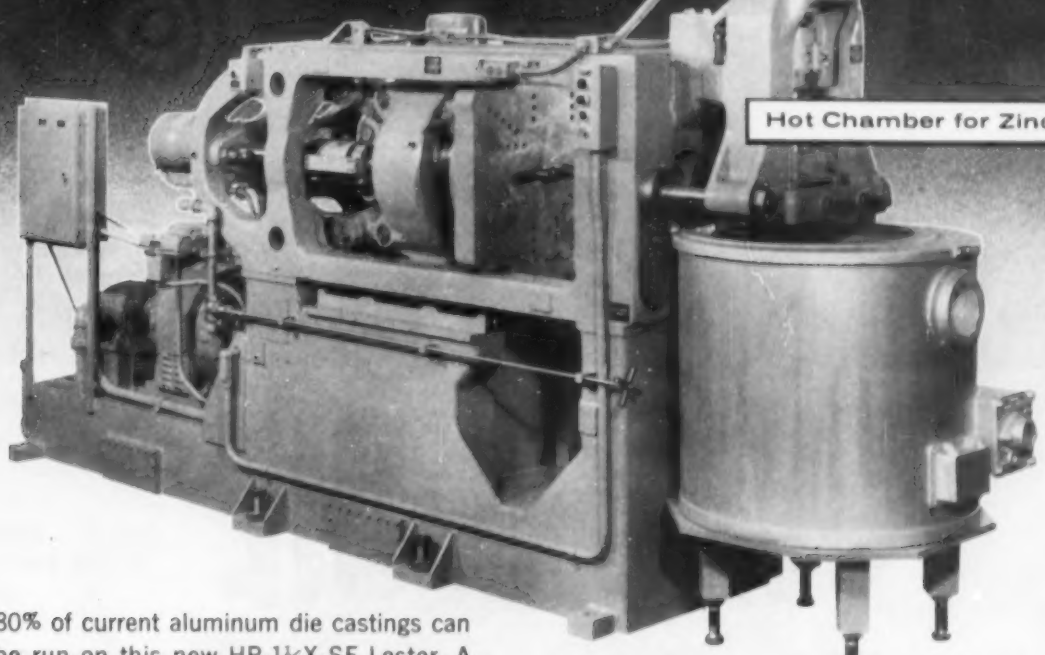
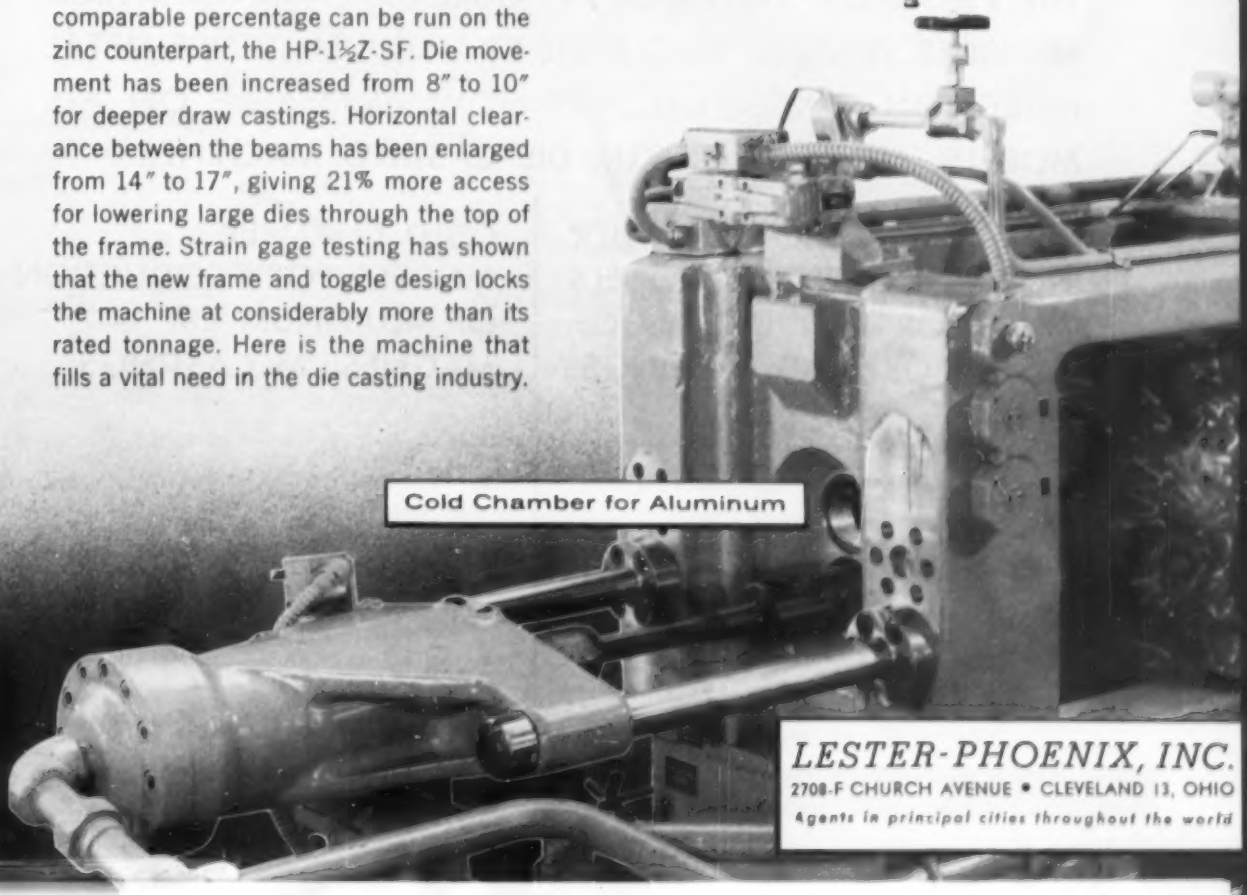
# NEW 200 TON LESTER
## DIE CASTING MACHINES



Hot Chamber for Zinc

80% of current aluminum die castings can be run on this new HP-1½X-SF Lester. A comparable percentage can be run on the zinc counterpart, the HP-1½Z-SF. Die movement has been increased from 8″ to 10″ for deeper draw castings. Horizontal clearance between the beams has been enlarged from 14″ to 17″, giving 21% more access for lowering large dies through the top of the frame. Strain gage testing has shown that the new frame and toggle design locks the machine at considerably more than its rated tonnage. Here is the machine that fills a vital need in the die casting industry.



Cold Chamber for Aluminum

*LESTER-PHOENIX, INC.*
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*Agents in principal cities throughout the world*

# KUX

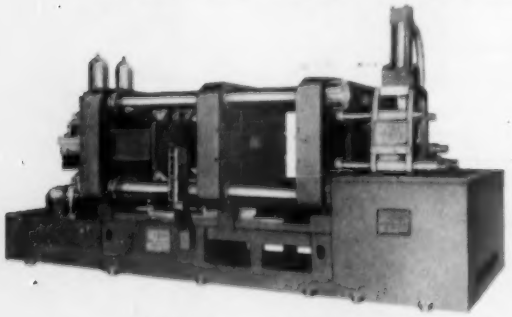
FIRST NAME IN DIE-CASTING MACHINES

## PROUDLY PRESENTS ITS REVOLUTIONARY NEW SYSTEM OF PRESSURE DIE-CASTING

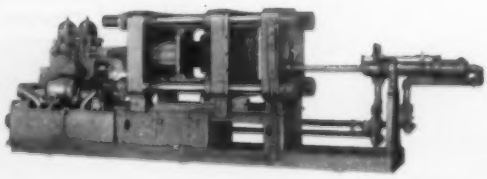
# VAC-U-DIE

THE **VAC-U-DIE** SYSTEM OF PRESSURE DIE CASTING—WHICH PROVIDES VENTING OF THE DIE BY VACUUM BEFORE METAL INJECTION TAKES PLACE—IS NOW AVAILABLE ON ALL MODELS, ALL SIZES OF KUX DIE CASTING MACHINES.

HOT CHAMBER PLUNGER GOOSENECK MODELS FOR PRODUCTION OF ZINC OR LEAD CASTINGS.



COLD CHAMBER MODELS FOR PRODUCTION OF ALUMINUM OR MAGNESIUM CASTINGS.



Builders of a full range of die-casting machines . . . from 25 tons to 1000 tons in size.

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# KUX
# VAC-U-DIE

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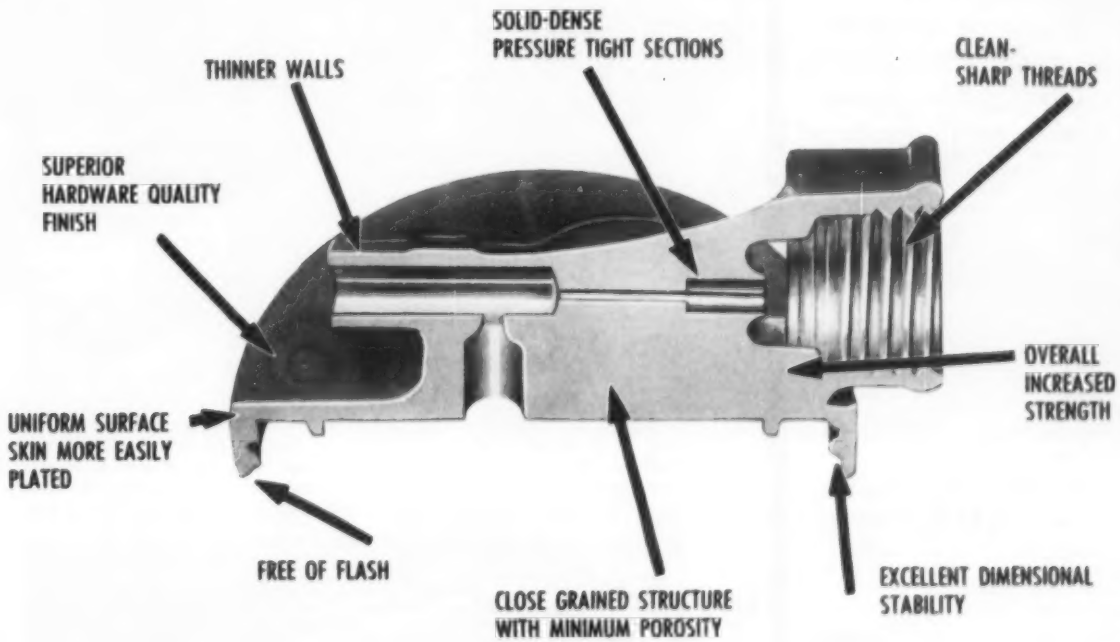


- Low original cost with no license fees
- No die enclosing hoods
- Assures production of castings which have highest density, minimum porosity, and true hardware finish
- Standard die-casting dies can be used, with only slight modifications
- No appreciable change in production speed
- Far fewer rejected castings, less scrap
- Lower injection pressures and speeds required—thus die life is extended
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- Casting wall thickness can be reduced for savings on metal costs

*Write for illustrated catalog showing complete line of KUX Die Casting Machines.*

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**HAMPDEN BRASS**

Die Castings have cleaner, smoother surfaces

Machining operations reduced to a minimum on (STANLEY) Power Plane

Hampden Brass's engineering department and the Stanley Electric Tool Division worked together to design the H33 Power Plane castings. These aluminum die-cast parts reduce machining time to a minimum. Each casting is of uniform thickness throughout, and all meet high quality standards in production quantities. Hampden Brass solved the problem of intricate coring and thin walls of the front and rear shoe, and the mating surfaces were used as cast . . . eliminating machining at the V-slide match. The result: quality die castings that fulfill every requirement at lower-per-unit cost.

**Let HAMPDEN BRASS Help You Solve Your Casting Problems!**

*Avail yourself of our engineering counsel . . . or write for a casting quotation today!*

Send for brochure, "Behind the Scenes" . . . complete digest of Hampden Brass's experience, equipment and facilities.

HB

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Established 1903
262 Liberty St.•Springfield, Mass.

*Producers of Sand, Permanent Mold, Die & Fiberglas Castings*

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## CASTING ABOUT

*continued from page 6*

**HAVE YOU HEARD ABOUT THESE NEW ALLOYS?** To meet new engineering requirements, or to solve long-standing production problems, the search for new and improved alloys continues. Here are several announced in the recent mails. Some will be the subject of more detailed reporting later when more data are available.

**New zinc die casting alloy** introduced by Sidney Kornblum Metals Co. adds zirconium to the standard alloys. Company officials claim a self-fluxing action to gain finer grain structure, higher tensile strength, improved castability, reduction of dross losses, and decrease in plating spit out. This patented alloy is reported to be readily mixable with the standard zinc alloys without harm.

**High temperature investment casting alloy** has been made available after five years of co-operative research and development work with the Research Laboratories Division of General Motors Corp., by Haynes Stellite Company, Div. of Union Carbide and Carbon Corp. Haynes has been licensed to produce and sell alloy GMR-235, a nickel-base, high temperature alloy containing chromium, molybdenum, iron and boron with aluminum and titanium as precipitation hardening agents. Produced both by air and vacuum melting, it is designed for investment cast turbine wheels, buckets and vanes for use at temperatures in excess of 1400 F. Good room temperature ductility, very low strategic alloy content, remarkable resistance to over aging at service temperatures for periods over 1000 hours are reported for the alloy. Haynes Stellite has produced more than 1000 production heats of GMR-235 to standard stress rupture specifications.

**Magnesium-thorium aircraft alloy,** a structural airframe material that combines light weight with strength and ability to withstand the intense heat generated by friction at supersonic speeds, has been announced by The Dow Chemical Company. The new sheet and plate alloy is designated HM21XA-T8.

**Vacuum-melted nickel alloy** from General Electric's Metallurgical Products Department is said to prove suitable for extended operation under load at temperatures of 1240 F. It is already being used in the form of forged buckets in the first stage of heavy-duty land gas turbines by GE's Gas Turbine Department.

**SPECIAL LADLE TRUCKS TO CARRY MOLTEN ALUMINUM** are features of the new Ford Motor Company aluminum casting plant being built at Sheffield, Ala. A quarter-mile private road from the Reynolds Metals Company's Listerhill aluminum reduction plant will connect the two operations. The new Ford plant, which will have both die casting and

permanent mold casting installations, will have a hot metal receiving building which will contain 10 holding furnaces . . . with total capacity of 560,000 pounds . . . for keeping the metal in molten form. Four additional furnaces will be used for melting metal trimmings.

**MOVIES OF METAL FAILURE** are being employed by the National Bureau of Standards to help gain an understanding of the fatigue phenomena. A special fatigue testing machine equipped with a clock-controlled 16 mm camera, takes time lapse motion pictures of aluminum specimens under torsional stress. The gadget was designed by J. G. Weinberg of the Bureau's mechanical metallurgy department.

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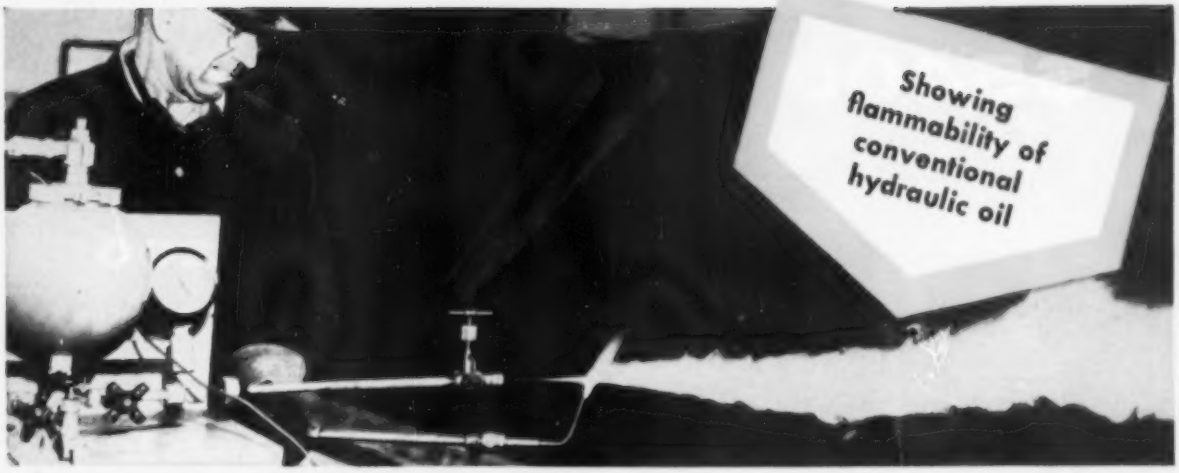

# Flame tests prove its fire-snuffing ability

**SHELL**
**IRUS**
**FLUID 902**

**Entirely new formula:** Shell Irus Fluid 902 is a special formulation . . . product of three years' development and field testing. It is suitable for nearly all industrial hydraulic systems, as a direct replacement for presently used oils. *Here is a fire-resistant hydraulic fluid that can be widely used.*

**Non-corrosive:** Shell Irus Fluid 902 contains no corrosive ingredients. It has no harmful effects on seals, fittings or bearings. It does not promote rust.

**No major modification necessary** . . . simply clean present fluid thoroughly out of system and replace directly with Shell Irus Fluid 902. You can use it with complete confidence. Write for test data and all information.

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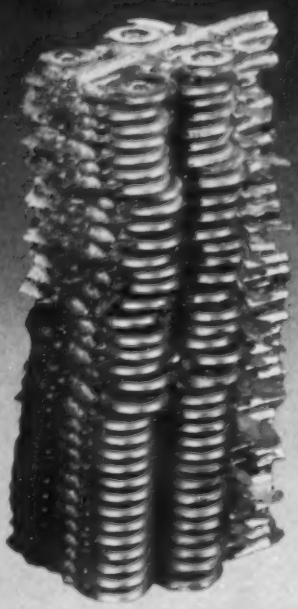
SHELL

# $5400 annual saving

## by $4200 investment in ECLIPSE FURNACE

New Double-Chamber Dry-Hearth-Type Metal Melter Proves Flexibility in Small Shop



### *Increases Production . . . Eliminates Rejects*

● The new Eclipse double-chamber dry-hearth-type metal melter—actually a new method—replaced two crucibles and one reverberatory furnace at Le Claire Manufacturing Co., Le Claire, Iowa, and has paid for itself at the rate of $450 a month in savings! The new melter combines advantages of Eclipse direct firing with the first truly separate melting and holding chambers. At Le Claire, the one dry-hearth melter has made this remarkable record supplying all metal for the plant's sand- and die-cast aluminum casting operations. Castings for power mowers, electric and gas motors, as well as many others, are cast from this one furnace. Actually designed for high-production operation, the melter gives even better results in larger foundries.

Pigs are melted on a steep sloping hearth which gives fast run-off of molten metal to the holding chamber. Gassing and agitation of the metal in holding chamber are eliminated because no cold metal enters the bath. Direct firing permits faster, more efficient heating, requires less fuel. All moisture is driven off while metal is melting . . . all oxide inclusions are deposited on surface of hearth where they are easily removed by raking. Hearth and holding chamber are separately heated and controlled for ideal melting and pouring temperatures. And there are more additional quality-improving and cost-saving advantages for your *large or small* operation than can even be suggested here! Write *today* for . . .

Bulletin C-80 ——→

**Eclipse®**

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ECLIPSE FUEL ENGINEERING CO. OF CANADA, LTD., 29 UPJOHN ROAD, DON MILLS, ONTARIO

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it's

# CRUCIBLE REXALLOY

## for abrasion, corrosion and heat resistant parts...with better finish

**1.** One of a pair, this blade of REXALLOY A shears hot glass during manufacture of TV tubes. Liquid cooled between operations, it offers maximum resistance to wear, corrosion, and thermal shock. REXALLOY blades outperform previously used high speed steel shears by a wide margin.

**2.** Nozzle for jet type oil well rock bit cutter. Made of REXALLOY 51, it stands up exceedingly well under severe cold abrasive conditions encountered in drilling oil wells.

**3.** Extrusion die insert of REXALLOY 33. Inside contours are cast within a few thousandths of finished size. REXALLOY inserts produce as many as six to ten times as many pushes as conventional hot work tool steel extrusion dies.

Here's what Crucible REXALLOY means to you: Castings of high hardness, even at elevated temperatures . . . excellent resistance to both corrosion and abrasion . . . smooth, clean finish.

What's more, REXALLOY castings, when made by the shell-mold process, can be cast to any shape. Dimensions are held to closer tolerances than ever before . . . practically all machining and grinding operations are eliminated—especially important with hard super-alloys like REXALLOY.

So if your application calls for a part with one or more of these characteristics, REXALLOY shell-molded castings are the answer. They are moderate in price (less than investment castings), closer in dimensions and finish than conventional castings. Let your Crucible representative give you the complete story of what they can do for you. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

**CRUCIBLE** first name in special purpose steels

## Crucible Steel Company of America

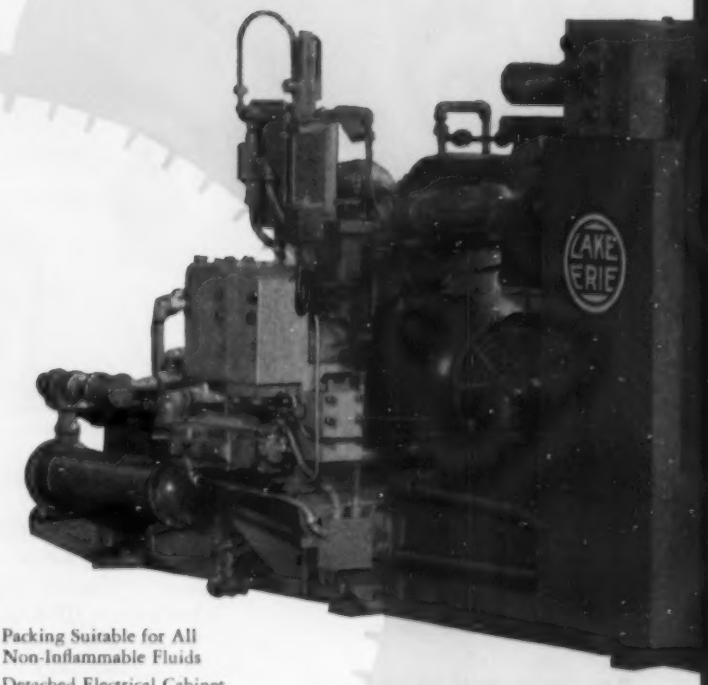
*For more information circle No. 23 on the Reader Service Card*

# NOW... *A Die Casting Machine that*
# EXPANDS WITH YOUR NEEDS

- Available in capacities of 250, 450, 650 and 850 tons.
- Hot chamber or cold chamber models as desired.
- All models are equipped with an improved version of the highly successful Wedge Cam Toggle. The incorporation of knuckled joints eliminates the use of pressure pins when under locking pressure.

*by* LAKE ERIE ENGINEERING CORP. BUFFALO, N.Y. U.S.A.

LAKE ERIE®




# TODAY...

- Buy the unique Lake Erie Series D "expandable" Die Casting Machine as a basic tool with only the essentials required for your present production. This saves money . . . yet gives you rugged characteristics and top quality never before obtainable in a simplified machine. Incorporated in all models of the new Series D are:

- Larger Die Area
- Low-Stressed Tie Bars
- Faster, Smoother, Die Closing
- Lower Frame — Engineered Working Height
- Manifold Valving
- New Knuckled, Wedge Cam Toggle
- Simplified Electrical & Hydraulic Systems
- Easier Conversion from Aluminum to Zinc
- Packing Suitable for All Non-Inflammable Fluids
- Detached Electrical Cabinet
- Reserve Pumping Capacity
- Mechanical Ejection
- Automatic Lubrication

OPTIONAL EQUIPMENT

- Safety Hook
- Screw for Die Height Adjustment

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# TOMORROW...

As you get into different types of production, you add any of the following features you need. They can be installed fast, at low cost, right in your plant.

- Multiple Corepull Valving
- Patented "Pressure-Pac" Injection System for Aluminum
- Hydraulic Ejector
- Safety Shield
- Die Cooling System
- Thermostatic Control of Water
- Power Unit Covers
- Positive Adjustable Cylinder Stops
- Vacuum Die Evacuation System
- Cold Chamber Plunger Assembly
- Hot Chamber Furnace Controls

## WRITE FOR DETAILS

Send today for Circular 255 describing this new and unusual "expandable" Die Casting Machine.

**LAKE ERIE ENGINEERING CORPORATION**

*520 Woodward Avenue, Buffalo 17, N. Y.*

*For more information circle No. 43 on the Reader Service Card*

# DATA OFFERED IN THIS MONTH'S ADS

*the Reader Service Cards on the facing page will get you these free reference materials. Circle the numbers and mail.*

1. **1,000 Shots Per Hour**—can be produced, according to bulletin A-10, an engineering report on small die casting machines, from ABC Die Casting Machine Co.

3. **Colloidal Dispersions**—Bulletin 425 from Acheson Colloids Co. describes the different lubricants available for foundry use.

5. **Induction Melting**—furnaces for both ferrous and non-ferrous metals are discussed in bulletin No. R-43 from Ajax Engineering Corp.

6. **Alloy Metal Powders**—The use of these powders in the fabrication of parts, and the properties of the parts made from them are covered in detailed reports from Alloy Metal Powders, Inc.

8. **Low Cost, High Speed**—die casting machines are described and all of the specifications given in an illustrated folder from the American Die Casting Machinery Co.

13. **Complete Specifications**—on the different models of die casting machines now being built are offered in literature from B & T Machinery Co.

16. **Precisely Controlled Alloys**—Vacuum or air melted alloys for all casting, rolling, forging or extruding uses are discussed in the new bulletin now available from Cannon-Muskegon Corp.

17. **World's Largest**—commercially-built die casting machine is described in a specification sheet from Cast-Master Inc. A brochure on other models is also available.

19. **New Applications**—of aluminum in permanent mold, centrifugal mold, and die casting are revealed in information from Centr-O-Cast Co. Fabricating techniques and costs of the applications are also offered.

21. **Entirely New**—Universal die casting machines are described in model 400-N bulletin from The Cleveland Automatic Machine Co.

24. **Sprue Bushings & Spreaders**—Complete specification sheets giving all the uses and advantages of specially designed sprue spreaders are available from Detroit Mold Engineering Co.

28. **Saves $5400**—Bulletin C-80 from Eclipse Fuel Engineering describes a new double-chamber dry-hearth-type metal melter, claimed to be actually a new method. Quality-improving and cost-saving advantages for both large and small operations are described.

30. **Alloys For Die Casting**—Informative technical and engineering information has been compiled by the Federated Metals Div., American Smelting & Refining Co. about alloys specifically for the die caster.

31. **Improved Metal Powders**—Resistox metal powders, said to produce superior bushings and structural parts are completely described in detailed reports from Glidden Co.

32. **Aluminum Die Castings**—A brochure has been published by Hampden Brass & Aluminum Co. that gives details about the experience, facilities, and equipment of the company.

33. **Fluxes for Aluminum or Zinc**—A technical bulletin giving important information on fluxing procedures and improved shop practice has been issued by the Haviland Products Co.

34. **Engineering Data**—technical information and recommended uses are included in a new booklet on zinc base alloys for die casting prepared by Henning Bros. & Smith.

36. **Die Castings**—A booklet, "Hoover Die Castings," gives much valuable information to the designer and production man concerned with the specification and use of die castings. Copies may be obtained from The Hoover Co.

38. **All New Design**—Bulletin 5400 issued by The Hydraulic Press Mfg. Co. describes the new die casting machine developed by H-P-M.

40. **"Cast to Outlast"**—is the title of a 16-page booklet showing how to keep costs in line on small parts. Published by The International Nickel Co. Inc., it is illustrated with case histories.

41. **Melting Furnaces**—for investment casting, such as the new model ID, are discussed in literature from the Detroit Electric Furnace Div., Kuhlman Electric.

43. **Die Casting Machines**—In detailed literature, Lake Engineering Co. has described and illustrated its die casting machines.

46. **Magnesium & Aluminum**—Literature and design information is available from Litemetal Dicast Inc. on the casting and machining of magnesium and aluminum alloys.

48. **Supermarket Shopping**—for customized conveyors is explained in MF Bulletin No. 200 issued by May-Fran Engineering Co.

53. **Close Tolerances**—An illustrated brochure offered by Ohio Precision Castings explains the OPC method of maintaining close tolerances on intricate work.

56. **Stainless Steel Plunger Rings**—A special bulletin has been released by Precision Piston Rings Inc. on the properties and advantages of their stainless steel plunger rings.

58. **Die Casting Machines**—Full information and specifications on both zinc and "cold chamber" die casting machines are offered by the Reed-Prentice Corp.

59. **Oil Base, Fire-Resistant Fluid**—Test data and information have been released by Shell Oil Co. on Irus Fluid 902, an oil base, fire-resistant hydraulic fluid used as a direct replacement for hydraulic oils now in service.

60. **Stainless Steel Ladles**—and skimmers for non-ferrous metals are listed in data from Spincraft, Inc. Sizes in stock and prices are also included.

61. **Powder Metal Presses**—A series of three bulletins has been issued by the F. J. Stokes Corp. —"Powder Metallurgy Today," catalog no. 801 on powder metal presses, and bulletin no. 670 on the model 640 press.

64. **Brass Die Castings**—to give all of the advantages of a pressure die casting with brass as the material are described in a 12-page booklet available from Titan Metal Mfg. Co.

*Continued on page 18*

# PMM AT YOUR SERVICE

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| 3 | 20 | 37 | 54 | 71 | 88 | 105 | 122 | 139 | 156 | 173 | 190 | 207 | 224 | 241 | 258 | 275 | 292 |
| 4 | 21 | 38 | 55 | 72 | 89 | 106 | 123 | 140 | 157 | 174 | 191 | 208 | 225 | 242 | 259 | 276 | 293 |
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| 9 | 26 | 43 | 60 | 77 | 94 | 111 | 128 | 145 | 162 | 179 | 196 | 213 | 230 | 247 | 264 | 281 | 298 |
| 10 | 27 | 44 | 61 | 78 | 95 | 112 | 129 | 146 | 163 | 180 | 197 | 214 | 231 | 248 | 265 | 282 | 299 |
| 11 | 28 | 45 | 62 | 79 | 96 | 113 | 130 | 147 | 164 | 181 | 198 | 215 | 232 | 249 | 266 | 283 | 300 |
| 12 | 29 | 46 | 63 | 80 | 97 | 114 | 131 | 148 | 165 | 182 | 199 | 216 | 233 | 250 | 267 | 284 | 301 |
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**THIS PLANT PRODUCES TYPES OF PARTS CHECKED BELOW:**

- ☐ Die Castings
- ☐ Investment Castings
- ☐ Powder Metal Parts
- ☐ Permanent Mold Castings
- ☐ Plaster Mold Castings
- ☐ Shell Mold Castings
- ☐ None of these

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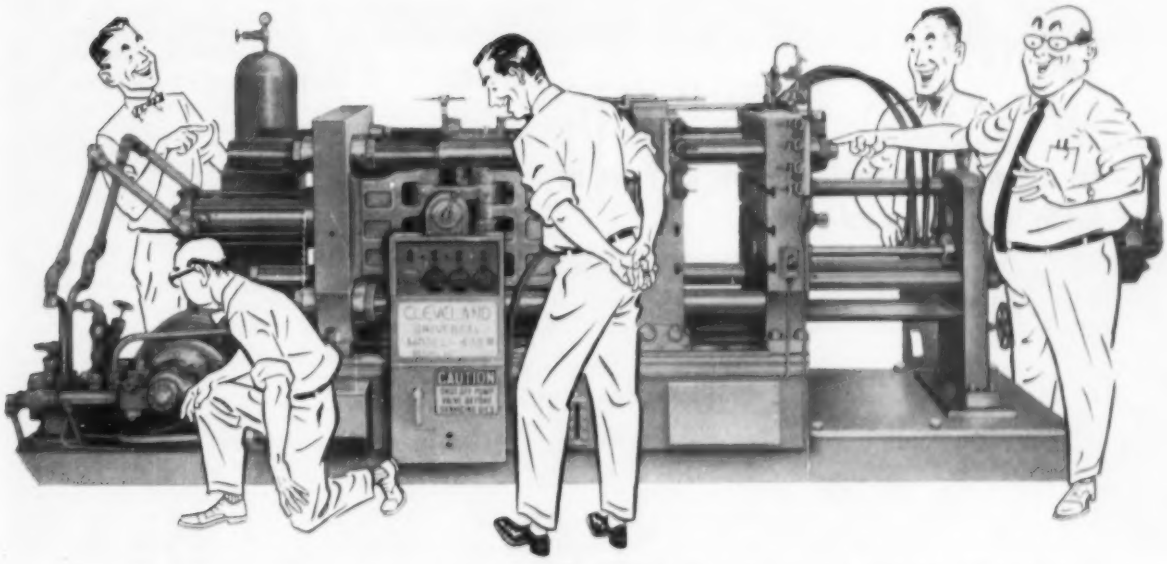
# WELL WORTH LOOKING INTO!

Cleveland Model 400-N shown with cold chamber end. Weight of metal per shot, including gate: 7.2 lbs., aluminum; 14.5 lbs., zinc.




# New CLEVELAND model 400-N

## Hydraulic Universal Die Casting Machine

*Write for new Bulletin*

From every angle, the new Cleveland Model 400-N has every feature you're looking for to give you better castings, faster, at less cost!

Here is a massively constructed, rugged, powerful machine. It locks dies at better than 400 tons pressure, *strain gauge tested*. Its faster die closing and opening speed will give you more shots per hour. Its rapid injection speed guarantees production of sound, dense, hardware-finish castings. Further, Cleveland's time-tested design and quality construction assure dependable, around-the-clock operation with machine maintenance at a minimum level.

Look into the new Cleveland Model 400-N, from every angle. You'll quickly discover why leading die casters call it the outstanding machine buy in its capacity range. Call in a Cleveland sales engineer for complete information and send for the new Model 400-N Bulletin.

***REMEMBER, CLEVELANDS CUT COSTS***

**THE CLEVELAND AUTOMATIC MACHINE COMPANY**

**4952 Beech Street**
**Cincinnati 12, Ohio**

SALES OFFICES: CHICAGO
CLEVELAND • DETROIT
HARTFORD • S. ORANGE

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# NOW

**EFFICIENT FIRE PROTECTION FOR HYDRAULIC SYSTEMS WITH THESE TWO HOUGHTON FLUIDS:**

THE NEW

## HOUGHTO-SAFE 1020

**For systems running consistently over 150°F. and for heavily loaded pumps and bearings**

HOUGHTO-SAFE 1020 is a new *fortified* synthetic hydraulic fluid expressly compounded to provide greater efficiency in systems where temperatures repeatedly exceed 150°F.

HOUGHTO-SAFE 1020 provides protection from rust or corrosion; resists foaming; is stable in use and storage, low in toxicity, and high in oiliness. It's *different* from former non-aqueous fluids.

## HOUGHTO-SAFE 620

**For all normal hydraulic temperatures and bearing loads (up to 85% of all needs)**

HOUGHTO-SAFE 620 is a time-proven water-base hydraulic fluid that provides maximum protection against hydraulic fires. Its efficiency is proven by more than 4 years use in industry and over 2 years in Navy carrier catapults.

HOUGHTO-SAFE 620 has no effect on standard packings used in oil or water hydraulic systems—is not toxic—and provides greater efficiency at lowest installed cost for most hydraulic systems.

***Find out today how you can now eliminate the fire hazard in any hydraulic system with the Houghton fire-resistant fluid that will provide greatest operating efficiency. Ask your Houghton Man or write to E. F. Houghton & Co., 303 W. Lehigh Ave., Phila. 33, Pa.***

HOUGHTO-SAFE

*. . . products of*

E. F. HOUGHTON & CO.

PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

***Ready to give you on-the-job service . . .***

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## DATA IN ADS

*continued from page 16*

**68. For Precision Painting**—A 20-page book shows the different types of spray masks offered by Wm. M. Fiore Inc. The book gives case-study illustrations of their use in decorating plastics, stampings, and die castings.

**69. Finishing Non-Ferrous Metals**—Detailed laboratory and engineering reports on the finishing of non-ferrous metals by the Iridite process are available from Allied Research Products, Inc.

**70. Finishing Costs Cut**—Free literature from Conforming Matrix Corp. explains how C-M products cut finishing costs through increased production.

**72. Rubberized Abrasives**—A comprehensive illustrated catalog published by Cratex Mfg. Co. tells how Cratex Rubberized Abrasives can cut costs, speed production, and insure quality results.

**73. Cleaning & Barrel Tumbling**—compounds, materials as well as the balance of the complete line are described in the latest complete catalog from the Frederick Gumm Chemical Co., Inc.

**74. Spectrographic Laboratory**—Complete technical information is available from Baird Associates — Atomic Instrument Co. on their complete line of spectrographic laboratory equipment.

**75. Low Cost Finishing**—The advantages of barrel finishing to give hand-buffed results at barrel finishing costs are given in "Facts and Figures Report on Honite Barrel Finishing" from Minnesota Mining & Mfg. Co.

**76. Machine Deburring**—of inaccessible holes can be done with Nobur tools. A complete catalog of these special tools is available from Nobur Mfg. Co.

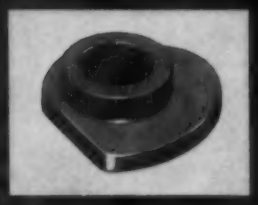
**77. Low-Cost Metal Cleaning**—in aircraft production is explained in a 48-page illustrated booklet "How To Clean Metals In Aircraft Production," published by Oakite Products, Inc.

**78. Blast Finishing**—How to cut finishing costs through the use of the hydro-finishing process is described in bulletin 1402 from the Pangborn Corp.

**80. Automatic Tapping**—for long production runs with repetitive thread accuracy, fewer broken taps, and other advantages is the subject of a brochure from Procunier Safety Chuck Co.

*Continued on page 29*

Here's the big news in the metal powder industry...



# REPUBLIC IRON POWDER with

## Controlled dimensional factor

The Metal Powder Division of Republic Steel is now producing three types of Iron Powder, each with a variable controlled characteristic. This is called *Controlled Dimensional Factor.*

Simply stated, it means that in the presence of copper, Republic Iron Powder—depending on type—can be made to grow, shrink or remain stable within acceptable limits. The powders have been designated as Type S for shrinkage, Type G for growth, Type N for normal.

Think what each of these types can do for you as a producer or designer of iron powder parts. For example, suppose your dies have become oversize through wear. By using Type S powder, with a controlled shrinkage factor, you can continue to use those dies and still produce parts to specified tolerances.

*Controlled Dimensional Factor* is exclusive with Republic and the Republic production process. CDF is an addition to the excellent Republic chemistry. CDF powders are also available with apparent density ranges of 2.3 to 2.5.

For engineering service or more information on how CDF can be applied to your production of iron powder parts, send the coupon.

**REPUBLIC STEEL**

*World's Widest Range of Standard Steels and Steel Products*

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☐ Send more information on Iron Powder with CDF.

☐ Have an engineer call.

Name_____ Title_____

Company_____

Address_____

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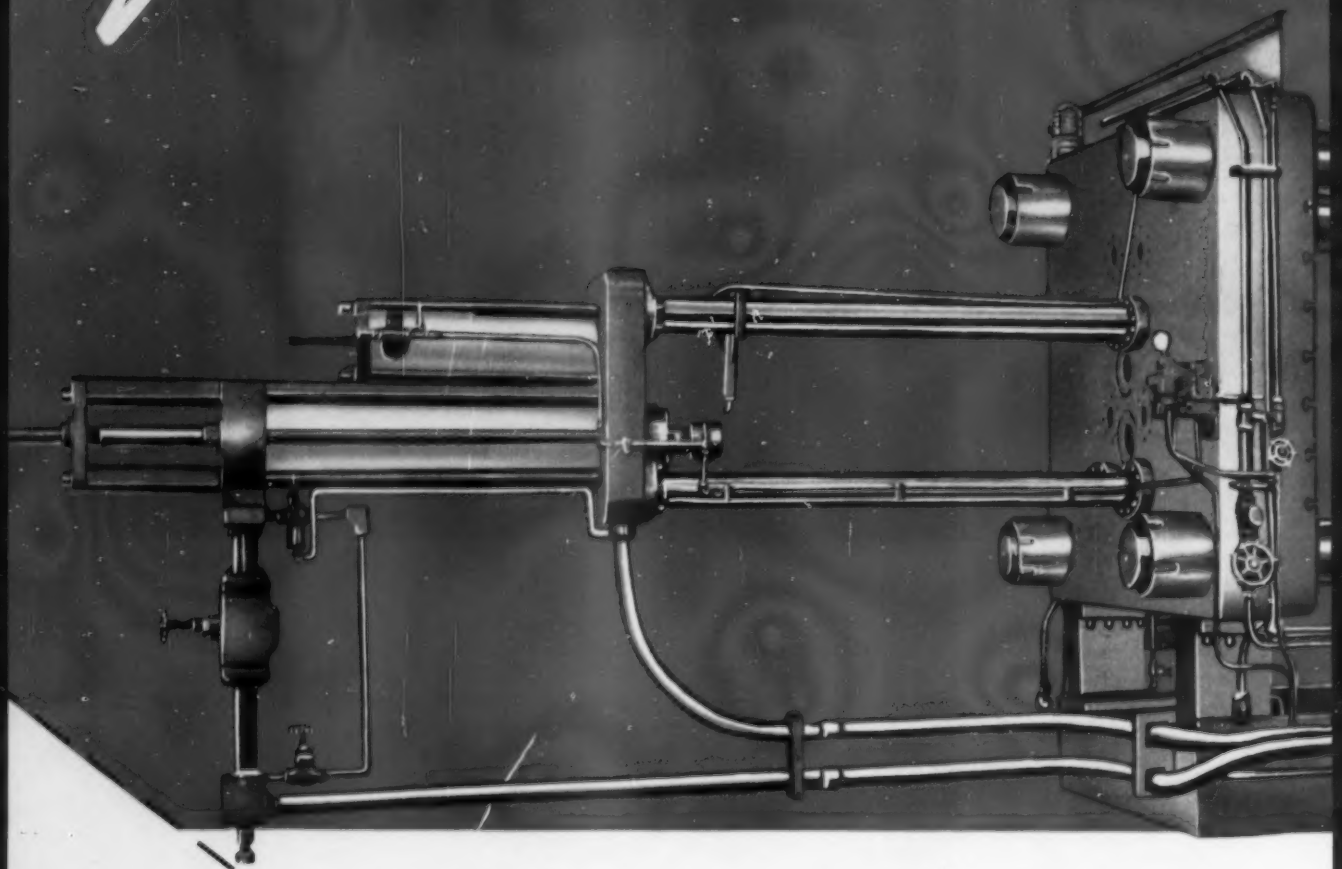
*For more information circle No. 87 on the Reader Service Card*

# CAST-MASTER Inc.

## Introduces THE WORLD'S LARGEST

☆ PRODUCES ALUMINUM CASTINGS UP TO 75 POUNDS



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*for complete information*

**CAST-MASTER INC.**
23901 Aurora Rd. • Bedford, O

**Please send me items checked:**

☐ Please send specification sheet on Cast-Master Model B-70-A

☐ Please send brochure illustrating other Cast-Master models

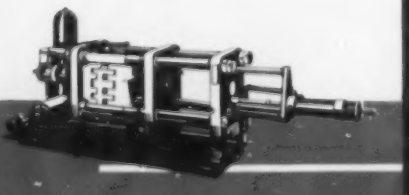
Name of Company

Address Zone State

Attention

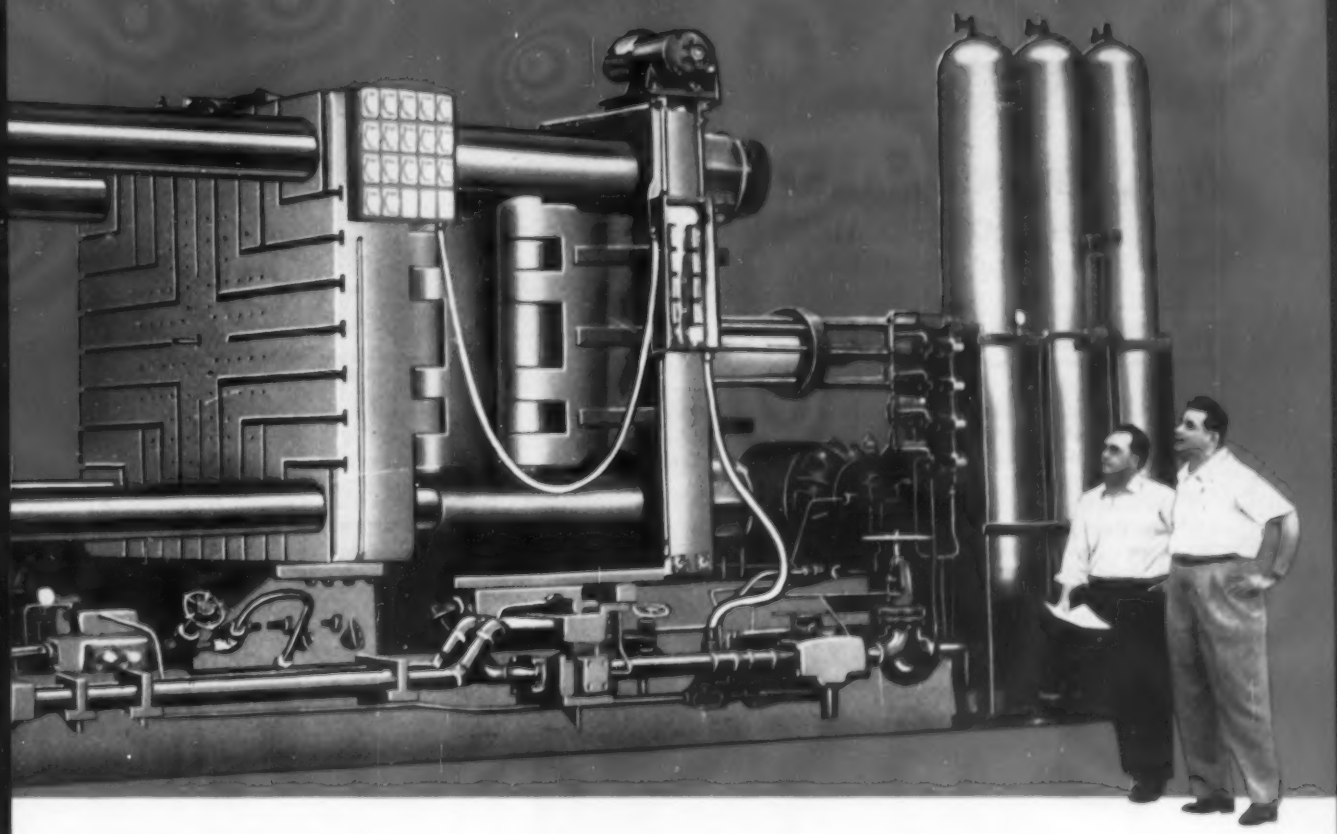
*For more information circle No. 17 on the Reader Service Card*

☆ WHETHER YOUR DIE-CASTING MACHINE REQUIREMENTS ARE BIG OR SMALL, SIMPLE OR COMPLEX, OUR DESIGN ENGINEERS HAVE THE SKILL AND KNOW-HOW TO COPE WITH ANY PROBLEMS EFFICIENTLY.



# Commercially-built DIE-CASTING MACHINE!

## ☆ OPERATES AT SAME CYCLIC SPEED AS SMALLER MODELS



To meet the growing demand for machines that are capable of turning out larger and larger castings we are proud to announce the completion of the Model B-70-A Cast-Master. It embodies all of the outstanding features that are common to the Cast-Master line plus several new engineering achievements. With the Model B-70-A, it is possible to die cast extra large castings more efficiently and more economically than ever before . . . opening up a completely new market to the die-casting industry.

**EASTERN REPRESENTATIVE, Milton Harmon, 18 Rock Road, Milford, Connecticut**

**CAST-MASTER *Inc.*** 23901 AURORA ROAD, Bedford, Ohio

**Now... SUPER MARKET SHOPPING FOR CUSTOMIZED CONVEYORS WITH MAY-FRAN STANDARDIZATION**

Developed to provide the ultimate of versatility, the May-Fran program of STANDARDIZATION permits users to create and construct their own conveyors to meet individual needs.

It literally provides a type of "super market" shopping for the straight, curved, inclined, take-up and discharge end sections required to meet the specifications of YOUR job requirements. Sections can be changed relative to length or width with only a minimum of downtime.



*Write today . . . ask for MF Bulletin No. 200*

**MAY-FRAN ENGINEERING, INC.**

1686 Clarkstone Road • Cleveland 12, Ohio

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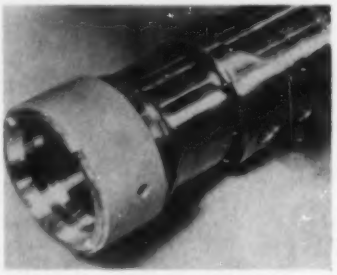
## CASTING ABOUT

*continued from page 10*

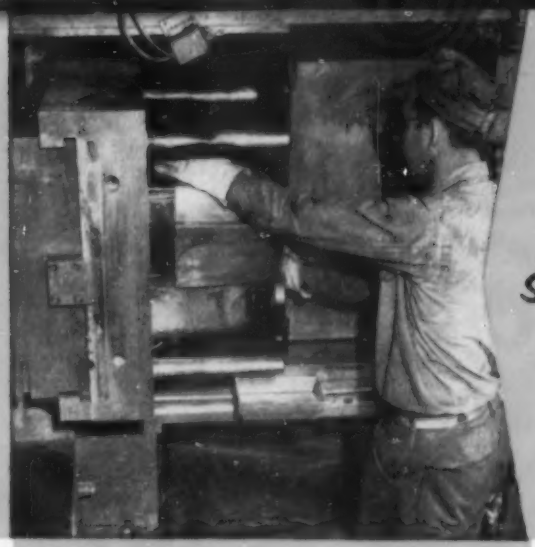
**PLASTIC-CLAD METAL PISTONS** for heavy duty hydraulic applications have been developed by Cleveland Pneumatic Tool Company to eliminate metal-to-metal surface contact in shock-absorbing struts of aircraft landing gears. Aluminum pistons have a thermosetting phenolic resin applied by wrapping a continuous sheet of cotton fabric impregnated with the plastic. When the desired thickness is built up, the resin-impregnated fabric is polymerized under heat and pressure. Knurling of the aluminum helps provide a good anchor. The cladding technique was developed by Synthane Corp.



**HOW TO WELD GRAPHITE** has been discovered by scientists of National Carbon Div. of Union Carbide, it was announced recently as the company dedicated its new multi-million dollar research laboratories at Parma, Ohio. This important discovery is expected to provide a new technique to advance the processing of materials for the atomic age. At the same time, announcement was made that the company had "grown" the largest single crystals of cadmium sulfide ever reported. A light-sensitive material, cadmium sulfide can be used in photo cells, solar batteries and, when properly activated, as a light-producing phosphorescent material.

**STAINLESS STEEL PISTON RINGS** with a completely new design and new method of manufacture (not powder metallurgy, the company says) have been developed after three years of research by Sealed Power Corp., Muskegon, Mich. Tests indicate more than 1,000 miles per quart of oil can be obtained with the new rings.

**STAINLESS STEEL RADIATOR PARTS** will be found in some of the new 1957 automobiles for the first time. The top and bottom tanks and baffle plate can now be successfully made of this metal. Joint announcement was made recently by McCord Corporation, pioneer radiator manufacturer, and Allegheny Ludlum Steel Corp., a leading producer of stainless steel.



# Johnson Motors
## Waukegan, Ill.
## selected Latrobe's VDC
## for this unique deep-cored die.

In manufacturing motor covers for its 30 horsepower outboard motor, Johnson Motors, a division of Outboard, Marine and Manufacturing Co., encountered a serious design problem. The overall height of the motor cover was 13½", but the largest machine in the plant had only a 16¼" die movement. It was therefore impossible to remove the cast part from the die casting machine, as the cover half of the die obstructed the area in front of the deep core.

To utilize existing die casting machines, Johnson Motors designed a die in which the main core and block are hydraulically moved sideways in tracks mounted on the machine. This die, made from Latrobe's VDC die casting die steel by Schultz Tool and Die, Chicago, permits the operator to easily remove the 4 pound aluminum casting from the machine and safely inspect the core which is actually outside the machine area. The die has performed successfully for several months on a 750 ton machine with prefill injection.

## Here's why leading die casters select Latrobe's VDC Die Casting Die Steel...

- machines easily
- high impact strength
- sound structure and freedom from porosity
- excellent non-deforming characteristics
- excellent resistance to wash and heat checking
- can be water cooled in service

Call your Latrobe representative . . . specify air hardening, 5% chromium VDC for your next die casting die. A wide range of sizes is stocked for *FAST* delivery.

**LATROBE STEEL COMPANY**

**Main Office and Plant: Latrobe, Pa.**

Branch Offices and Warehouses in Principal Cities

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**ATOLS**
**TOOL AND MOLD CORPORATION**

**DESIGNERS & FABRICATORS**

of

**QUALITY MOLDS**

for the

**DIE CASTING INDUSTRY**

*Complete designing and engineering. Modern plant & equipment includes BG-21 4' x 6' & BL-3620 Keller Duplicators.*

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**Chicago 39, Ill.**
**BErkshire 7-0800**

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## BETWEEN THE LINES

*the editor's viewpoint on articles in current and forthcoming issues*

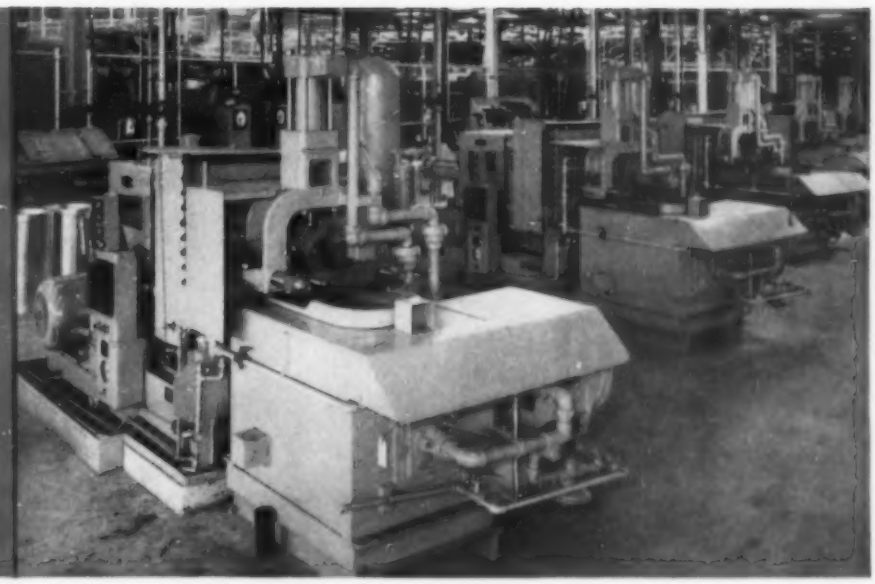
**ACTUAL SAVINGS ACCOMPLISHED** are rarely available to report, since most companies prefer to reveal savings only in terms of percentages, hours or number of operations. However, actual dollar and cents comparisons between some powdered metal parts and the assembled stampings and screw machine parts they replace, are published in this issue. A leading clock manufacturer is making important savings by his use of small powdered metal components.

**NOT DIFFICULT BUT IMPORTANT** is the cleaning of zinc die castings prior to plating or painting. The success of all subsequent finishing operations hinges upon the care with which cleaning is accomplished. For this reason, PMM presents a discussion of the cleaning of die castings in the Finishing Section this month.

**IT LOOKS LIKE A LONG JUMP** from the manufacture of textile machines to producing office equipment, but an old-time New England builder of textile machinery has made the leap. In an effort to diversify its products, the company has turned to the manufacture of offset duplicating machines. Their previous experience with shell mold castings helped them in planning the new product, which includes more than 120 shell mold castings. The complete story is revealed in this issue of PMM.

**THE CLASSIC DIE CASTING** has always been the automotive carburetor. It is very doubtful that this complex device could have been manufactured economically in the quantities needed by the auto industry except by die casting. This is one of the earliest and most successful applications of the die casting process. Now, with one GM car this year offering a fuel injector as optional equipment and the other car builders planning their own fuel injection systems, considerable interest has been shown in whether or not the new units will make the same important use of the die casting process. PMM has asked the companies who are now well along with their fuel injector designs, whether major components will be die cast, and if so, which alloys will be used. The first article on this subject appears in this issue of PMM, and photos of some prototype fuel injector castings are published for the first time. After the first of the year, the designs of other manufacturers will be published as soon as they are available.

**ONLY TWO MORE WEEKS** are left for you to get your company a free listing in the First Annual Directory of Jobbing Die Casters which will be a big feature of the January PMM. Already, nearly 400 commercial die casting plants have sent in information about their companies to be listed. November 15 is the closing date. For buyers of castings this should be a most important directory, telling names and addresses, metals cast, additional facilities available, trade names and trade marks.



One section of the production floor at this plant shows how their REEDS are set up for continuous, efficient production of a variety of zinc castings like those shown here.

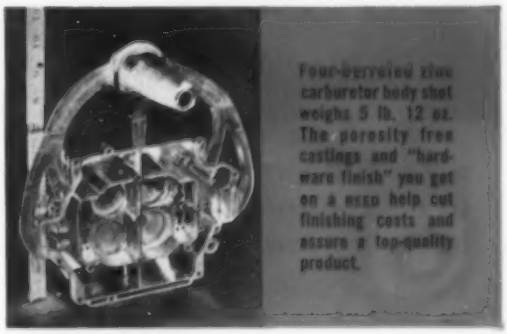
# Why Did One Large Carburetor Manufacturer Choose 63 REED-PRENTICE DIE CASTERS?

When one of the largest zinc die casting operations in the country uses 63 Reed-Prentice machines, you know there must be sound reasons behind it. Perhaps these same reasons could give cost-cutting answers to your own die casting problems. For you will find both the #1½ and #2 REEDS are engineered and built for rugged, dependable service.

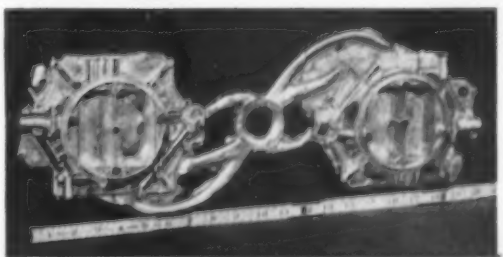
*Just check some of the* REED *features:*

- Gooseneck and furnace arrangement provides 675 lbs. of usable zinc above liner port, means longer operation without refilling.
- Heat-resistant cast steel pot and gooseneck. Elimination of stress points gives longer pot life. Gooseneck is designed for easy removal.
- Thicker platens minimize die deflection. Outboard support for movable die plate helps preserve permanent alignment by supporting load directly under die. This eliminates forward tip and cuts leader pin and bushing wear.
- Automatic lubrication of the toggle mechanism cuts wear, reduces maintenance.

*To get full information and specifications on both zinc and 'cold chamber'* REED *die casting machines, write to Reed-Prentice Corp. today at 677 Cambridge St., Worcester 4, Mass.*



Four-barreled zinc carburetor body shot weighs 5 lb. 12 oz. The porosity free castings and "hardware finish" you get on a REED help cut finishing costs and assure a top-quality product.



6 lb. shot produces two carburetor parts. Note how the Reed-Prentice feature of full locking tonnage on every shot has eliminated "pressure back off" and held flashing to a minimum.

REED-PRENTICE

Affiliate of PACKAGE MACHINERY COMPANY

WORCESTER 4, MASS.

BRANCH OFFICES: NEW YORK • CLEVELAND • CHICAGO • BUFFALO • DAYTON • DETROIT • KANSAS CITY • LOS ANGELES REPRESENTATIVE: MINNEAPOLIS — CHAS. W. STONE CO.

*For more information circle No. 59 on the Reader Service Card*

*shock absorber inner cylinder head shown about 5 times actual size*

## a YALE powdered metal part...designed to take constant pounding and come back for more

A small part, about the size of a quarter. But without it, the family car would ride like a bumpy farm wagon.

It's an inner cylinder head for an automobile shock absorber. Used on one of America's most popular cars. Its perfect performance is a critical element in providing a smooth, level ride.

Here is why YALE* was chosen to produce this part:

The manufacturer needed positive assurance that, in use, this part would not show appreciable wear from the original close tolerances required for a smooth ride.

He had to be sure the millionth part would be as accurate as the first. That we could handle the large quantities he needed. That he'd get imaginative engineering and delivery on schedule.

He found that YALE powdered metal parts answered every requirement. And it's quite probable that the car you're driving gives you a better ride because of his decision.

Perhaps you have a problem a YALE powdered metal part can solve. Our engineers are as close as your telephone whenever you'd like to talk about it.

*REG. U.S. PAT. OFF.

**powdered metal parts**

**YALE & TOWNE**

THE YALE & TOWNE MANUFACTURING COMPANY, POWDERED METAL PRODUCTS DIVISION, 9335 BELMONT AVENUE, FRANKLIN PARK, ILLINOIS

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WANT TO MELT A MOUNTAIN OF METAL

ONE LABEL FOR **AL.**

TWO LABELS FOR **ZN.**

***Significant Labels*** *of modern metal founding*

*at the* Die Casting Division *of*

**MADISON-KIPP** Corporation

Please clip this ad as a reminder to contact
us when you have die casting requirements.

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MADISON-KIPP CORPORATION
213 WAUBESA STREET • MADISON 10, WIS., U.S.A.

• Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

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# WANT TO MELT A MOUNTAIN OF METAL?

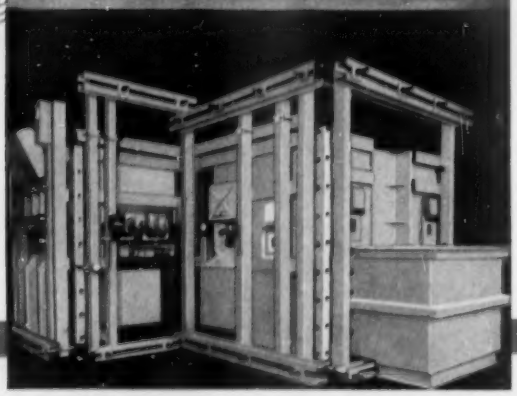
# THESE BIG STROMANS WILL DO IT...BUT FAST!

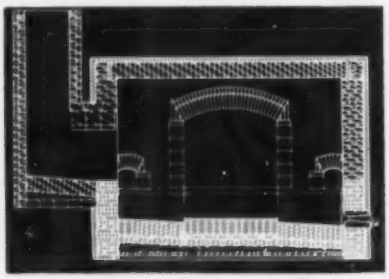
## STROMAN LARGE SIZE REVERBERATORY FURNACES

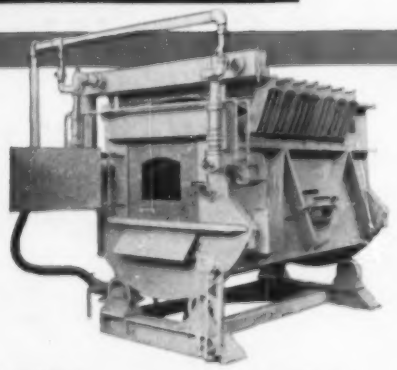
### For Melting Unlimited Capacities of Aluminum, Zinc or Brass

These reverbs are built to assure heavy duty production for Smelting, Extrusion work, Die Casting, Permanent Molding and Foundry melting. Now in operation in some of the most prominent plants in the country, they have proved their ability to deliver large tonnages of metal, are easy to work with and around . . . operate most economically and are easy to maintain. Their efficiency and economy will amaze you and convince you of their superiority.

Furnaces of this type are designed to meet customers' individual requirements . . . let our engineers show you how to achieve utmost efficiency and economy in your melting operations.

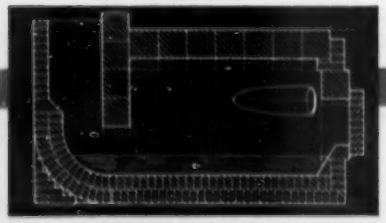




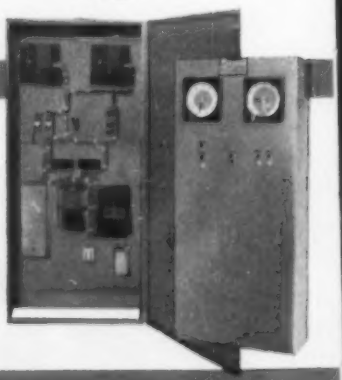


## STROMAN TYPE "SW" CRADLE TILTING FURNACE FOR ALUMINUM MELTING SIZES FROM 1,000 TO 3,000 POUNDS

An ideal furnace for breakdown to supply hot metal to holding furnaces for die casting or permanent mold. Also for distribution to the molding floor in sand casting foundries. Tilted by means of an air or hydraulic ram. Furnished complete with gas or oil burners or combination burners, blower to furnish combustion air, and lining made of standard fire brick shapes.



*Automatic temperature and safety controls available if desired.*



## STROMAN CUBICLE TYPE CONTROL PANEL

Stroman design monitor for furnace metal temperature, refractory temperature, high limit blower motor, circuit, electric ignition, and flame safety control, with completely automatic built-in warning system.

Don't forget STROMAN make furnaces for the melting of brass, bronze, aluminum, magnesium, grey iron and all other metals in sizes to meet your needs no matter how large or small.

***Write for complete catalogue today!***

*Circle No. 92 on the Reader Service Card*

**STROMAN FURNACE & ENGINEERING CO.**

DIVISION OF THE PETERSEN OVEN CO. • FRANKLIN PARK, ILL.

## DATA IN ADS

*continued from page 18*

**82. Shell Mold Casting**—Techniques and advantages of shell molding are described in the "G-E Shell-Molding Manual." The manual contains findings from G-E's shell-molding laboratory.

**83. Proper Metal Selection**—Bulletin 116-205 issued by Hitchner Mfg. Co. tells how the right metal selection for investment castings can often increase efficiency and reduce costs.

**84. Special Casting Problem?**—A brochure and other data offered by Investment Casting Co. are published to help solve special casting problems by using one-piece investment castings.

**85. Grinding & Machine Work**—A descriptive booklet issued by the Martin Grinding and Machine Works Inc. describes the Martin plant and its facilities.

**87. CDF Iron Powder**—Complete information is now available from Republic Steel on its latest iron powder development: controlled dimensional factor.

**89. Polishing, Buffing Lathes**—A catalog on a complete line of polishing and buffing lathes is offered by Hammond Machine Builders.

**90. Safety Hydraulic Fluids**—Two new grades of Ucon Hydrolubes are discussed in a new booklet published by Carbide and Carbon Chemicals Co., "Ucon Hydrolubes Spell Safety," Form 40134.

**92. Melt Any Metal**—A complete catalog is offered by the Stroman Furnace & Engineering Co. describing Stroman's line of furnaces for the melting of brass, bronze, aluminum, magnesium, grey iron, and all other metals in any size.

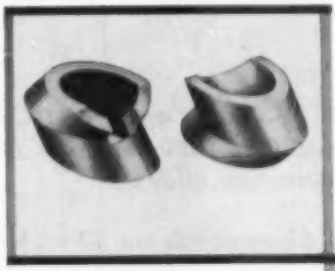
**93. Pilot Plant Casting**—In a new bulletin, DB-52-500, Westinghouse Electric Corp. discusses the facilities for pilot plant casting production and prototype manufacture in the new metals plant.

**94. Fluid Power Units**—Bulletin ML-3 issued by the Bellows Co. tells how to realize many of automation's practical advantages without heavy investment. The four-color booklet describes the line of Bellows fluid power work units.

**95. Equipment & Supplies**—The latest catalog from Alexander Saunders & Co. describes the company's line of investment casting supplies.

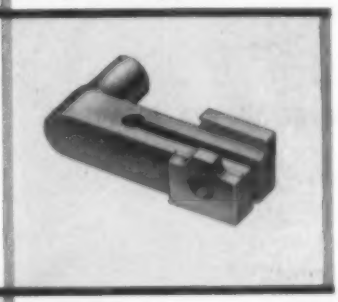

Basic Considerations in Selecting alloys . . . . for your INVESTMENT CASTINGS

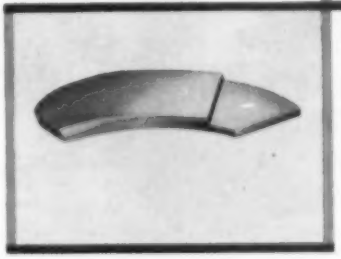
DO YOU KNOW THAT . . . an investment casting produced from a low cost metal may be MORE EXPENSIVE than one cast from higher priced material that may also have characteristics better suited to your requirements.



These angle connectors were originally investment cast in mild steel, a low cost material. To overcome corrosion problems, 303 stainless was substituted and because of its better castibility there was no increase in cost. Now, silicon brass is being used at a 10% saving on the original selling price.

This gage mount is an excellent example of unusually good casting characteristics of one metal offsetting a decidedly higher material cost. Originally priced in SAE 8620 steel, it was changed to beryllium copper at a 15% saving in unit price.





This simple textile machine part requires a high degree of wear resistance. Casting in the right metal provided better properties at lower cost than when machined from tool steel.

Get more complete information for this is only a small part of the story telling how the right metal selection for investment castings can often increase efficiency and reduce costs.

WRITE today for Bulletin 116-205 . . . it's FREE!

HITCHINER
*Manufacturing Company*
MILFORD 7, NEW HAMPSHIRE
REPRESENTATIVES IN PRINCIPAL CITIES

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***Thousands of Diecasting Technicians From All Over the World Who Attended the International Foundry Trades Fair (GIFA) in Duesseldorf . . . Saw and Acclaimed***

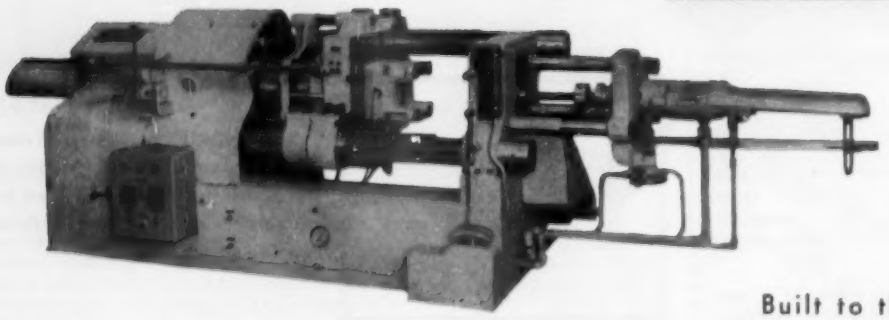
# TRIULZI

## PRESSURE DIECASTING MACHINES

***THE LATEST MODELS:***

- ***HORIZONTAL and VERTICAL cold chamber machines, from 30 to 1500 tons, for Zinc, Aluminum, Copper, and Magnesium alloys.***
- ***Hot chamber from 30 to 400 tons for Zinc alloys.***

***AND HERE'S OUR NEWEST:*** ..... **TRIULZI castmatic**



Catalogs and specifications upon request

Built to the design
DIECASTERS PREFER

**OFF. A. TRIULZI S.A.S.**

Milan (640) Italy ..... Via Giovanni da Procida 8
Cables: Triulzipres ..... Milan Works: Novate Milanese

**INJECTION AND COMPRESSION MACHINES FOR PLASTICS**
**HIGH PRESSURE HYDRAULIC PUMPS ..... HYDROPNEUMATIC PLANTS**

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# Dodge Custom-made **Special Alloy Steel Goosenecks**

for longer service life

less maintenance

■ Here's the biggest news in die casting in years: a custom-made special alloy *steel* gooseneck that will outlast and outperform iron and alloy iron goosenecks currently available . . . and provide greater operational savings! Developed through years of experience and association with the die castings industry, Dodge Special Alloy *Steel* Goosenecks provide many advantages:

- Will outlast iron and alloy iron goosenecks by as much as 4-5 years.
- Maintenance problems are fewer because of long service life.
- Down time is reduced to a minimum because of long service life.
- Designed and made of special alloy steel, they prevent cracking . . . bottom breakout . . . spout erosion.

Each Dodge Special Alloy *Steel* Gooseneck is custom made to specifications by the Finished Products Division of Dodge Steel Company. Facilities are available for producing any size gooseneck for any die casting machine. Goosenecks are furnished either rough machined or machined with sleeves. Dodge provides a complete engineering service in the designing and production of steel goosenecks. Your inquiries are solicited, without obligation, of course. Ask too, about pots and other die casting machine parts including nozzles, spouts, plungers, etc.

DS

## DODGE STEEL COMPANY

***Finished Products Division***

6501 Tacony Street • Philadelphia 35, Pa.

THE MOST IMPORTANT ALLOY IN A STEEL CASTING IS QUALITY

*For more information circle No. 25 on the Reader Service Card*

# 3 ways Glidden helps you produce better METAL POWDER PARTS

***Superior metal powders*** — Glidden Resistox Metal Powders have been subjected to the most exhaustive tests by parts manufacturers. Result: parts made from Glidden metal powders are judged superior to parts produced from other powders. They permit faster production, with greatly improved finish, appearance and performance characteristics.

***Complete field service and lab facilities*** — Whether you are interested in establishing a new metal powder parts department, or desire to improve operations of an existing department, Glidden can help you. The Glidden metal powders lab and the services of Glidden technicians are available to your metallurgists at any time.

***World's largest blender*** — Glidden can produce up to 30,000 pounds of powder in one batch, more than any other producer... an important factor in complete uniformity of mass-produced parts.

A thorough examination of the manufacturing methods you are now using may lead to substantial savings. Make certain you are not passing up the economies, speedier fabrication and superior parts performance you can get by using Glidden Resistox Metal Powders. Write for complete details.

**THE GLIDDEN COMPANY**

**Chemicals — Pigments — Metals Division**

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*For more information circle No. 31 on the Reader Service Card*

# New LINDBERG–FISHER Autoladle

Here, for the first time, is a ladling unit that makes automatic casting of aluminum not only possible but practical. The Autoladle has been thoroughly tested and proven in service.

**"LITTLE JOE"** provides these advantages:

- Adaptable to induction, electric resistance or fuel-fired reverberatory furnaces.
- Ladled metal is withdrawn from beneath surface of bath.
- Precise, accurate control of any size shot up to 30 lbs.
- No interruption of the casting cycle during charging of metal.
- No variation of size of shot due to metal level changes.
- Composed of special refractory materials so arranged that ladled metal cannot come in contact with any metal.

*We call it*

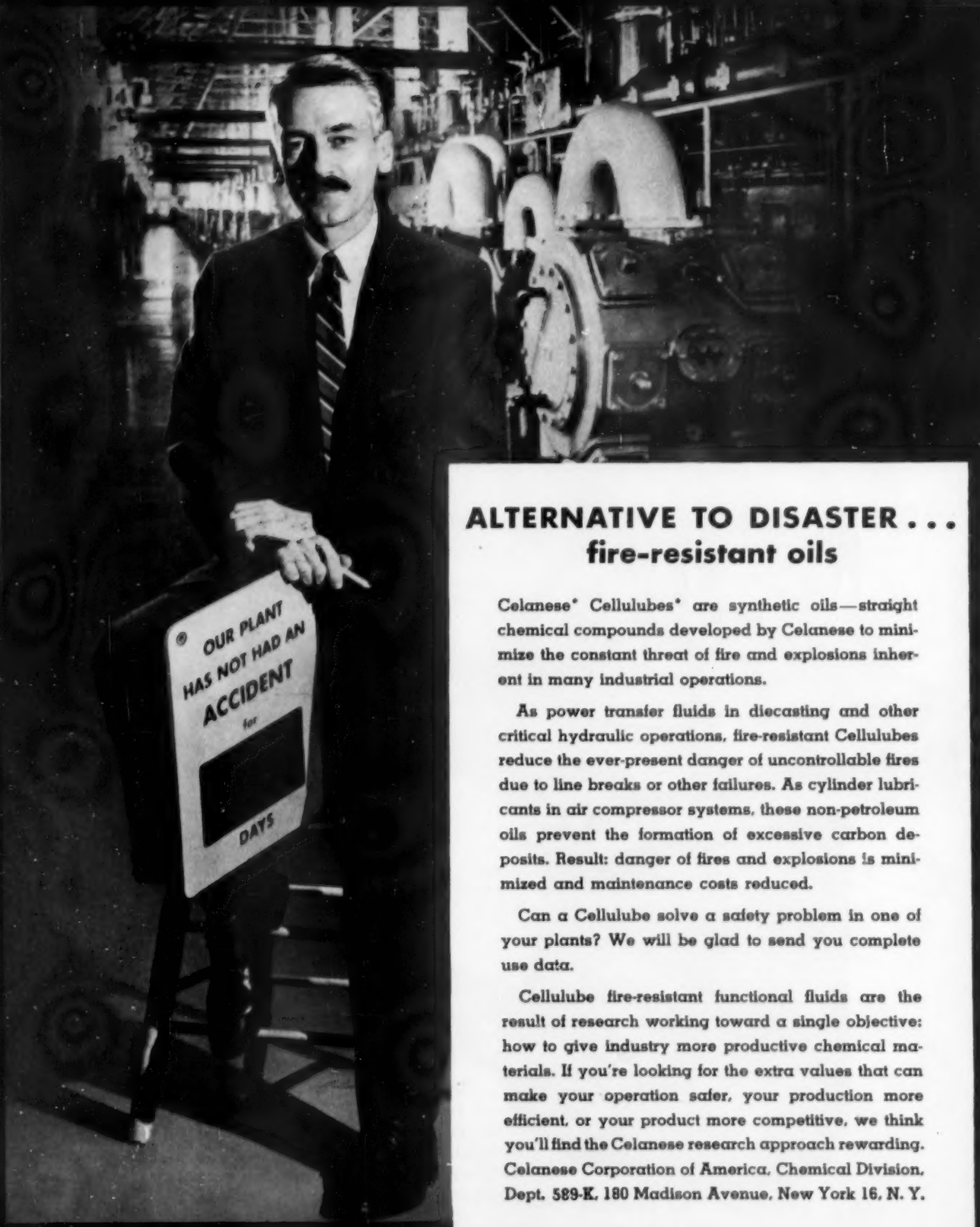
**"LITTLE JOE"**

To the best of our knowledge this is the first practical automatic ladling unit yet devised. It will fill an important need in many casting operations. For complete information, get in touch with your nearest Lindberg Field Representative (see your classified phone book) or write direct.

**LINDBERG FISHER MELTING FURNACES**

**A Division of Lindberg Engineering Company, 2463 West Hubbard Street, Chicago 12, Illinois**

*For more information circle No. 91 on the Reader Service Card*




# ALTERNATIVE TO DISASTER . . . fire-resistant oils

Celanese* Cellulubes* are synthetic oils—straight chemical compounds developed by Celanese to minimize the constant threat of fire and explosions inherent in many industrial operations.

As power transfer fluids in diecasting and other critical hydraulic operations, fire-resistant Cellulubes reduce the ever-present danger of uncontrollable fires due to line breaks or other failures. As cylinder lubricants in air compressor systems, these non-petroleum oils prevent the formation of excessive carbon deposits. Result: danger of fires and explosions is minimized and maintenance costs reduced.

Can a Cellulube solve a safety problem in one of your plants? We will be glad to send you complete use data.

Cellulube fire-resistant functional fluids are the result of research working toward a single objective: how to give industry more productive chemical materials. If you're looking for the extra values that can make your operation safer, your production more efficient, or your product more competitive, we think you'll find the Celanese research approach rewarding. Celanese Corporation of America, Chemical Division, Dept. 589-K, 180 Madison Avenue, New York 16, N. Y.

**Basic reasons . . . . . for improved products**

Acids
Alcohols
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Esters

Functional Fluids
Gasoline Additives
Glycols
Ketones
Oxides

Polyols
Plasticizers
Salts
Solvents
Vinyl Monomers

Celanese* CHEMICALS

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Agricultural, automotive, aviation, building, electrical, paper, pharmaceutical, plastics, surface coatings, textile

## PMM LETTERS

*the readers' forum*

### CAN ZINC BE ANODIZED?

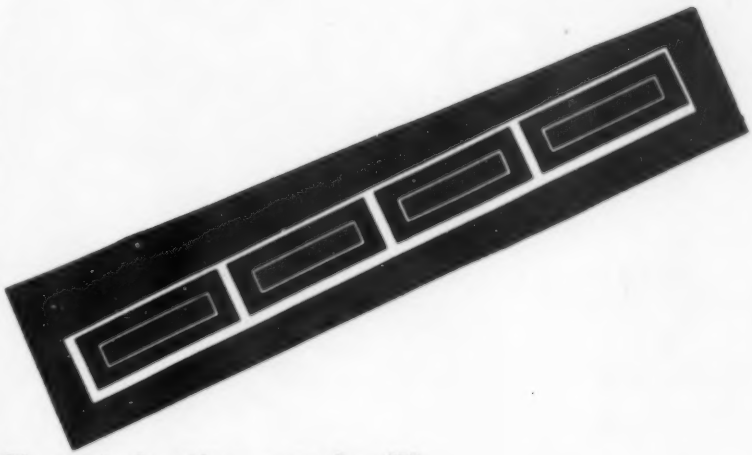
I have just received my first copy of your magazine since entering my subscription, and I am very impressed by the wide coverage of the die casting field and related metal finishing which you have given in your magazine. I will be looking forward to each issue as it reaches my desk to get the latest information in the field of metal molding.

In your September 1956 issue under "LETTERS, the readers forum" page 26, you received an inquiry from a reader regarding anodizing of zinc. This stated that a research project at Battelle Memorial Institute had been initiated, commissioned by the American Zinc Institute. You explained that the anodizing of zinc has been performed for many years and that, "One company has a proprietary method of applying an anodic coating to zinc and it is very successful on zinc die castings." I would appreciate receiving any information you can give us which would put us in touch with the company you mentioned.

Our company manufactures precision snap action switches and we have numerous requirements for pushbutton housings, toggle switch actuators, etc., made of zinc die casting material, which must meet military specifications including 100 hr. salt spray test. We have contacted one of our suppliers of anodized aluminum parts, and they inform us that zinc die castings cannot be anodized to such a degree as to improve the corrosion resistant properties. Your article states that the problems of anodic coatings for zinc die casts is "mainly for corrosion protection". — A. C. S. (Engineering Department)

*The Anozinc process, a proprietary method of anodizing zinc alloys and zinc plated surfaces, is not new. It has been used a long time to improve resistance to corrosion. We do not have information available concerning how well it meets military specifications. Reader A. C. S. and the others who have written in to ask for more information have been referred to the manufacturer, United Chromium, Division of Metal & Thermit. — Ed.*

*Continued on page 79*

**To retain the good will of the DIE-CASTING INDUSTRY, which forms an important segment of Federated's business, we adhere to these three basic policies:**

1 We ship only the finest alloys we are able to produce. Only metals of highest purity are used and every furnace heat is checked spectrographically and chemically for composition, grain structure, fluidity and castability.

2 We offer personal service to the die-caster. Our trained sales and service engineers are available to discuss existing production problems or make recommendations without obligation to you. Hundreds of die-casters will tell you that this Federated extra is more than just lip service.

3 An important obligation of our research laboratories is a constant effort to improve die-casting alloys. Federated's family of zinc-base Di-Metals is a result of this sound metallurgical research.

We have informative literature available to help the die-caster. Or, if you prefer to discuss your problem with one of our sales or service engineers, just call your nearest Federated plant or office.

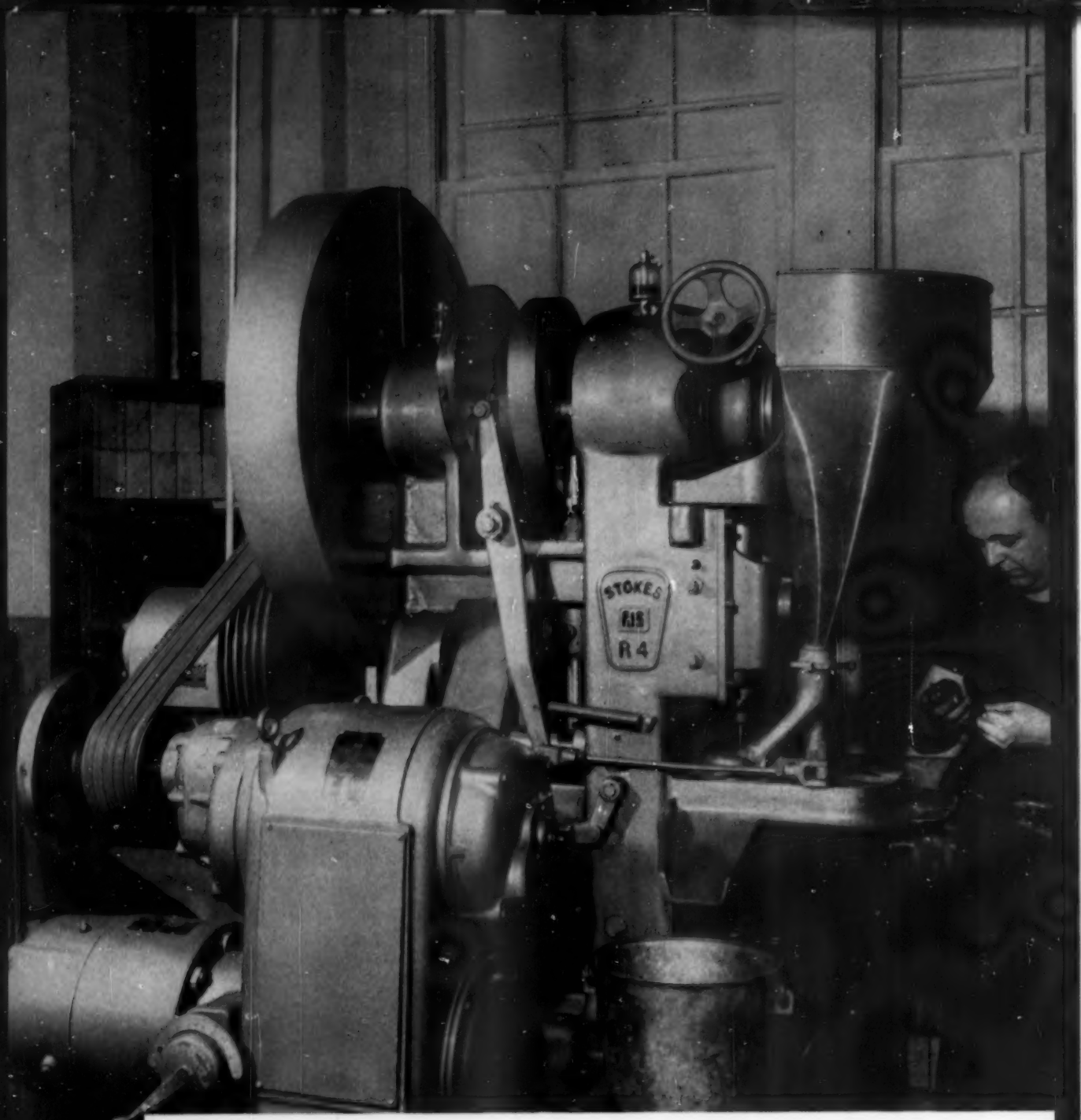
Federated Metals

DIVISION OF AMERICAN SMELTING AND REFINING COMPANY
120 BROADWAY, NEW YORK 5, N. Y.
*In Canada: Federated Metals Canada, Ltd., Toronto and Montreal*

Aluminum, Anodes, Babbitts, Brass, Bronze, Die Casting Metals, Lead, Lead Products, Magnesium, Solders, Type Metals, Zinc Dust

***For more information circle No. 30 on the Reader Service Card***


← *Circle No. 18 on the Reader Service Card*




On the Stokes Model R-4 press shown above, Whitney Chain Company produces these parts from sponge iron powder blended with small amounts of copper, graphite and zinc stearate. Tolerances as pressed are less than ±.001" on I.D. and O.D.—and ± .0025" on length.

# Powder metal production— on Stokes Press—

## *up to 200% faster than machining at Whitney Chain Co.*

Close tolerance parts are being produced at a rate of 750 to 2000 per hour on a Stokes powder metal press, at Whitney Chain Company, Hartford, Conn. According to Whitney Chain's manager, the same parts would be made at only 450 to 600 per hour by turning from bar stock—an increase in production of 67% to 233% by switching to economical powder metal compacting!

Dimensional tolerances, moreover, are readily held to required limits. On these cylindrical parts, inside and outside diameters are kept within ± .001" *after* sintering . . . length within ± .005".

By using carbide dies and flame-plated core rods, tolerances of parts coming from the press are held well within these values, to reduce the magnitude of the variations that occur during sintering. Stokes press design is especially suitable for the tooling for this kind of close tolerance work.

Pioneering in powder metal pressing, Stokes has led in the development of presses that apply this versatile concept to production of thousands of parts made from metals, alloys, non-metals and mixtures. Stokes fully automatic compacting presses are enabling many manufacturers to reduce labor and machining costs, eliminate waste of metal stock, and often produce properties unobtainable by conventional alloying methods.

From 35 years of Stokes experience in this field come numerous original design features that bring you the best in operating efficiency, ease of set-up and quality of output. The new Model 640 press is the latest in the Stokes line. It affords easy set-up and control, with independent press adjustments and direct-reading calibrations. It is built for high-precision production, with inherent protection against breakage of parts during the critical breakaway and injection operations. Totally enclosed, it runs with maximum safety, needs little maintenance, and handles a wide variety of work.

The Stokes Advisory Service will be glad to consult on your specific powder metal application, and to accurately estimate your anticipated production costs. This consulting service can include laboratory production of sample parts, design and machining of punches and dies, and complete installation and instruction in your own plant. Write today for a consultation, and for the following literature: "Powder Metallurgy Today"; "Stokes Powder Metal Presses"—Catalog No. 801; "Stokes Model 640 Powder Metal Press"—Bulletin No. 670.

*Powder Metal Press Division*
F. J. STOKES CORPORATION
5526 Tabor Road, Philadelphia 20, Pa.

**STOKES**

**These leading custom producers profit from Stokes powder metal presses**

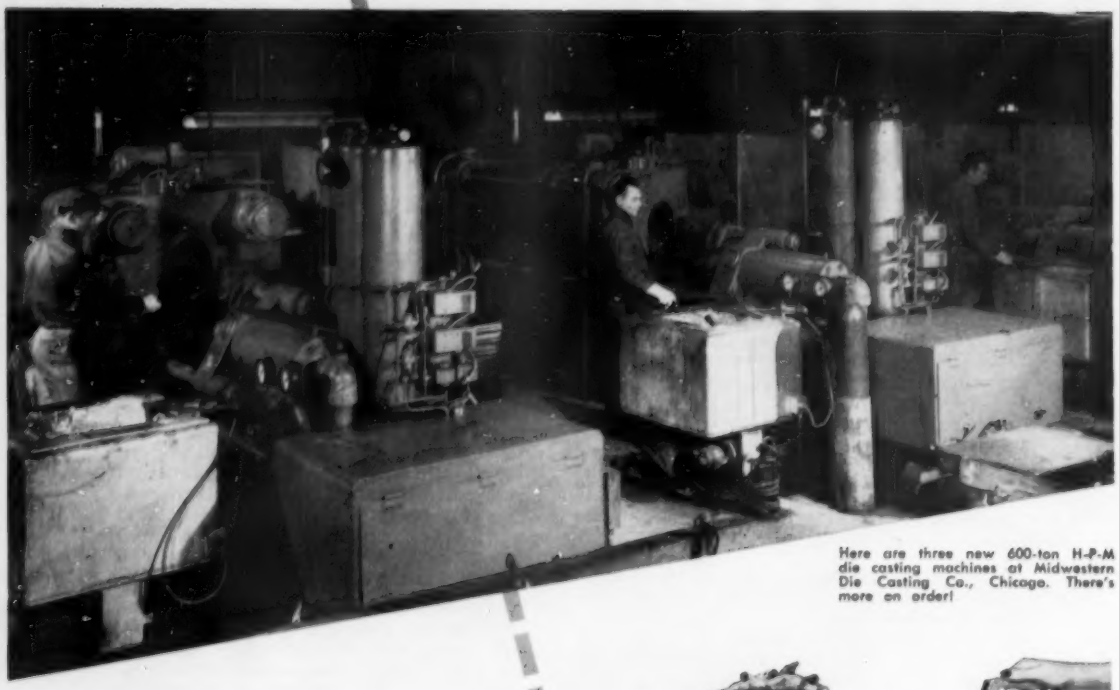
**$25,000 yearly saved** . . . $30,000 machine tool outlay avoided . . . by making lock parts in a Stokes press at Dixon Sintaloy, Inc., Stamford, Conn.

**$20,000 per year cost-reduction** was made on a wringer drive gear of iron and copper powder, for use on "Whirlpool" washers. Parts made by the Presmet Corporation, of Worcester, Mass. . . . on Stokes powder metal presses.

**82% drop in cost** is the story behind this drive gear for a home ice cream freezer . . . formed in a single operation on a Stokes press at Yale & Towne's metal products division, Franklin Park, Illinois.

*For more information circle No. 61 on the Reader Service Card*

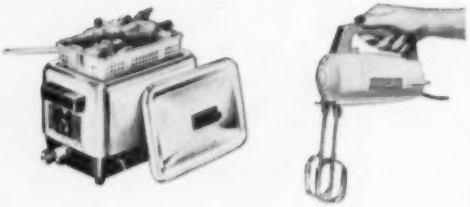
# MIDWESTERN CHOSE H-P-Ms
## for more die casting value per dollar...



Here are three new 600-ton H-P-M die casting machines at Midwestern Die Casting Co., Chicago. There's more on order!

## *These Facts Add Up...*

All new—from stem to stern—that's H-P-M's Die Casting Machine. Result? Better die castings for you. H-P-M's new exclusive mechanical link-wedge lock is the heart of the new design. There's plenty of "beef" in locking and frame members. The clamp is preloaded to full rated tonnage . . . reducing flash . . . producing parts to accurate dimensional tolerances . . . improving quality and density. Let H-P-M engineers show you the "more value per dollar" facts. A national survey reports die castings will be used in 74% of new products being designed. Are you ready for more business?



The Dormey Hand Mixer and Dormeyer Friwell are typical appliances incorporating die cast parts made at Midwestern. The motor housing of the mixer and the deep well of the Friwell are currently in production.

*Write for Bulletin 5400*

**THE HYDRAULIC PRESS MFG. CO.**
Mount Gilead, Ohio, U.S.A.
A DIVISION OF KOEHRING COMPANY

HPM

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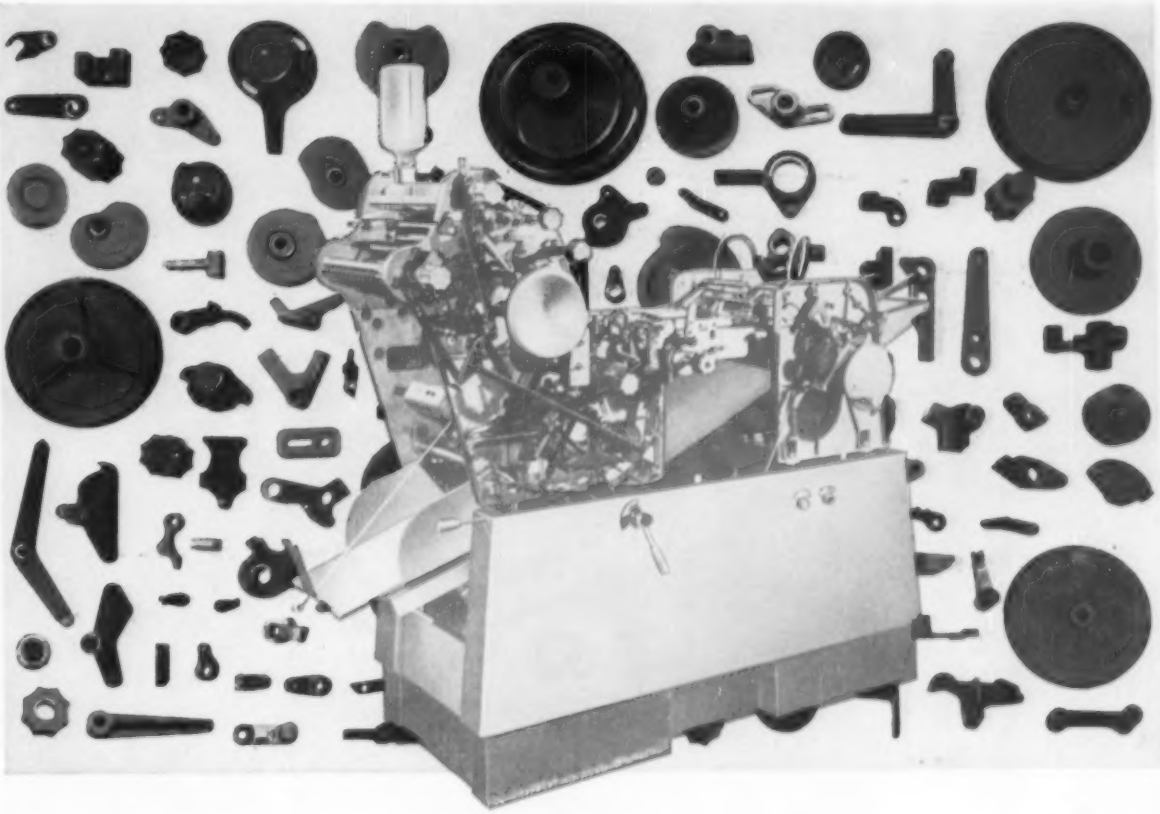


This machine features

## OVER 125 SHELL-MOLDED PARTS

produced exclusively with G-E SHELL-MOLDING RESINS

Whitin's *Masterlith* Duplicator* contains over 125 shell-molded parts! And here are the advantages that Whitin gets from selecting shell molding over other foundry techniques:

1. **Smoother finish** that drastically reduces machining, minimizes the need for expensive machining equipment.
2. **Closer tolerances** that enhance *Masterlith* Duplicator performance.
3. **Sounder internal structure** that cuts reject losses.
4. **Precise dimensional reproduction** of intricate shapes.

Whitin uses General Electric shell-molding resins *exclusively* in producing parts for the *Masterlith* Duplicator, relying on them for batch-to-batch uniformity and correctly balanced properties.

*Mfd. by Whitin Business Equipment Corporation, Whitinsville, Mass.

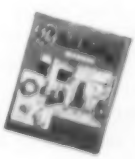
**How can shell molding help YOU?**

General Electric maintains a shell-molding laboratory in Pittsfield, Mass., to help foundrymen and casting buyers solve problems and evaluate the process. Ask us about it, or write today for a free copy of the *G-E Shell-Molding Manual* which describes and illustrates the techniques and benefits of this new casting method. *CHEMICAL AND METALLURGICAL DIVISION, General Electric Company, Section 6F5C1, Pittsfield, Massachusetts.*

*Progress Is Our Most Important Product*

GENERAL ELECTRIC

FREE SHELL-MOLDING MANUAL



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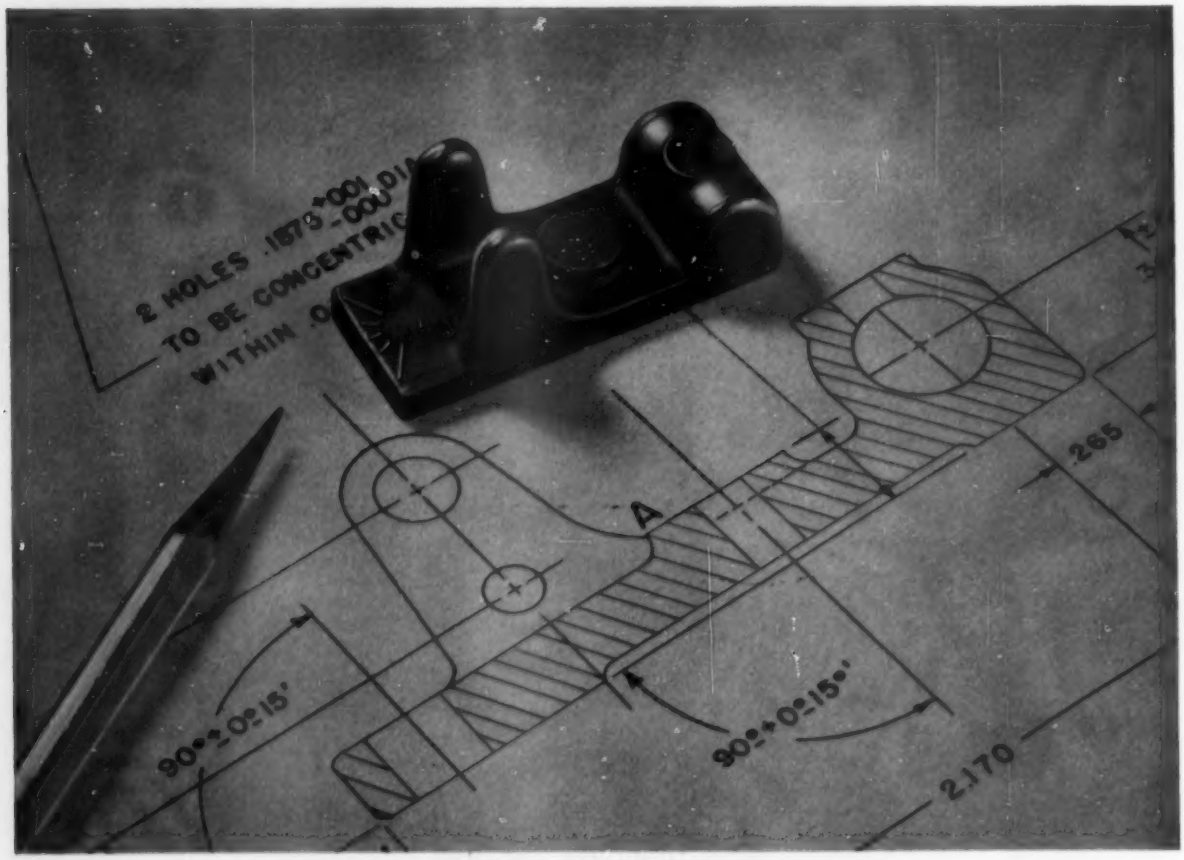


**Produced for half the cost** — Part of the "Vapoflash," this Inconel alloy precision casting withstands searing gas turbine exhaust temperatures.

# Design big savings into small parts with Inco precision investment casting

Many small parts can be designed to cost less by taking advantage of Inco precision casting.

Manning, Maxwell & Moore, Incorporated, reduced costs 50% on the part shown above. It's the body of the "Vapoflash," a device that measures exhaust temperatures in gas turbines. To withstand heat ranging up to 1500°F., it's made of Inconel* nickel-chromium alloy.

Costs argued against two obvious methods of production. Machining from bar stock would take *17* operations. Machining from sand castings would take *8* — still too many.

A dilemma? *Easily solved.* Designed to be precision investment cast by Inco, the part takes only 5 finish machining steps.

**High precision . . . less machining**

Whenever you have a high-melting-point metal part which is 6 inches x 5 inches or smaller, weighs under 3 lbs., requires starting tolerances as close as plus or minus .005 inch per linear inch, and needs 5 or more fabrication steps, consider precision casting. It often gives required precision with less machining.

Send us a sample or blueprint. Our Engineering Department will be glad to submit their recommendations and quotations on Inco precision investment castings.

*Registered trademark

**The International Nickel Company, Inc.**
67 Wall Street New York 5, N. Y.

**5 Advantages of Inco Precision Castings**

- **Save up to 60% of production costs.**
- **Longer life with harder alloys.**
- **Little or no machining required.**
- **Wider design latitude.**
- **Higher alloys at lower cost.**

**"Cast to Outlast"**

This handsome, 16-page booklet shows how to keep costs in line on small parts. Illustrated with many case histories. Write for a copy . . . now.

INCO

# Inco Castings . . . Precision, Sand, Centrifugal

*For more information circle No. 40 on the Reader Service Card*

## PATENTS

*Copies of all patents reviewed can be secured from U. S. Patent Office, Dept. of Commerce, Washington, D. C. for 25¢ each.*

A METHOD OF PREPARING IRON POWDER in which finely diveded iron oxide is held in a horizontal reducing retort in a fluodized condition. The fluodizing is accomplished by blowing reducing gas through the bed of iron oxide with sufficient force to cause fluodization, but not material transport. During the time the oxide is maintained in this condition, the temperature is raised sufficiently high to cause reduction of the oxide by reducing components in the fluodizing gas. Since the material becomes less turbulent as reduction approaches completion, a metal oxide such as zinc or tin oxide in amounts of about 10 percent by weight of the iron oxide is added. These oxides do not reduce under the operating conditions and maintain the bed in a condition so that fluodization can continue until all of the iron oxide is reduced. After complete reduction the metallic iron powder and the unreduced metal oxide are separated.

Process of Preparing Metal Powders by a Fluo-Solid Reduction Process—Patent No. 2,758,021—Joseph E. Drapeau, Jr. and Richard J. Halsted—assigned to The Glidden Co.—issued Aug. 7, 1956.

A PROCESS FOR REMOVING PATTERNS of wax and plastic from investment molds having thin unsupported walls formed by dip-coating one or more times, but when the walls are not sufficiently strong to withstand the expansion pressures created by heating the pattern. The invested pattern is immersed in a liquid that is heated to a temperature between the melting point of the pattern material and the boiling point of the liquid. The invested pattern is held in the heated liquid for a sufficient length of time to melt enough pattern material, immediately adjacent to the wall, to provide for expansion of the remainder of the pattern. The mold is then removed from the liquid and heating continued to melt the remainder of the pattern.

Process of Removing Wax, Plastic, and Like Pattern Materials from Thin Shell Molds—U. S. Patent No. 2,759,232—Geza Demeter and James C. Johnson and Francis X. Maher, Jr.—assigned to Arwood Precision Castings Corp.—issued August 21, 1956.


# There's safety in these NEW numbers

**UCON** BRAND **Hydrolube 150-CP**
(Viscosity—approx. 150 S.U.S. at 100° F.)

**UCON** BRAND **Hydrolube 275-CP**
(Viscosity—approx. 275 S.U.S. at 100° F.)

***Yes, there's safety in these two new grades of UCON Hydrolubes —CARBIDE's safety hydraulic fluids.***

## Greater safety for machines

These new UCON "CP" Hydrolubes...

- Contain improved liquid and vapor phase corrosion inhibitors for the common metals.
- Have good lubricity. Special anti-wear agents provide improved pump life and performance characteristics.
- Have high viscosity indexes—150 to 160.
- Have low pour points—can be used at sub-zero temperatures.
- Have no harmful effects on packings and seals. Leakage losses are often lower than with other hydraulic fluids.
- And, are made in the two standard viscosity grades—others can be supplied to fit specific requirements.

## Safety for men and property

- The resistance of UCON Hydrolubes to burning has been proved by years of exhaustive testing in the laboratory and, by more than 8 years of practical application under standard industrial conditions. UCON Hydrolubes are water-base hydraulic fluids—the water content is the key to their fire-resistance.
- And, for all practical hydraulic purposes, UCON Hydrolubes are non-toxic to workmen.

*For safety's sake*, get all the facts. Write *today* for the new booklet, "UCON Hydrolubes Spell Safety," Form 40134.

CARBIDE AND CARBON CHEMICALS

**CARBIDE AND CARBON CHEMICALS COMPANY**
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.

"Ucon" is a registered trade-mark of Union Carbide.

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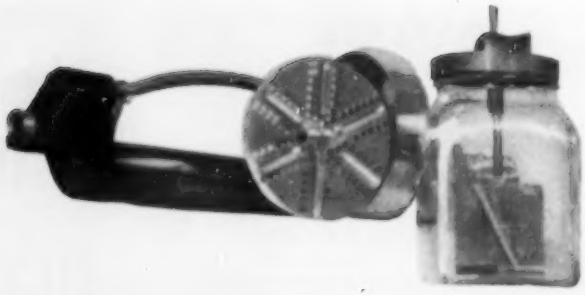
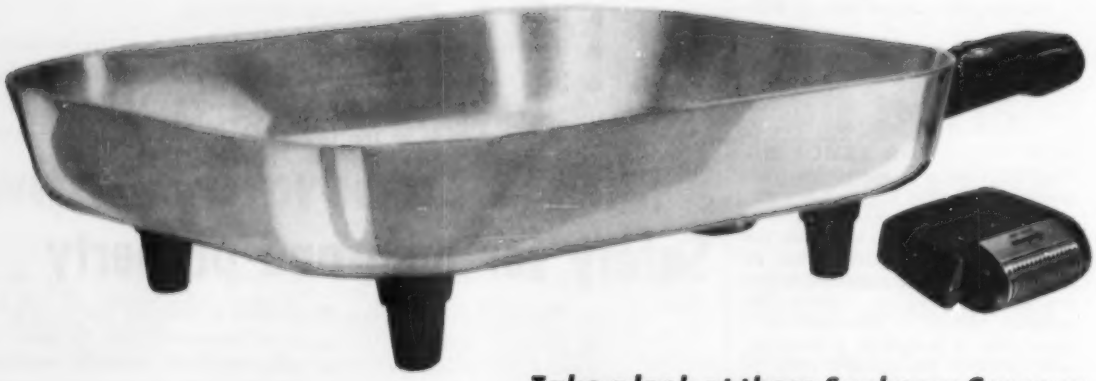


*Sunbeam*...Home Appliances...

# How Doehler-Jarvis die castings help produce high-quality products



***Take a look at these Sunbeam Corporation Appliances.***

Every one has features made possible by die castings.

Notice the frypan . . . Three critical requirements were successfully met by Doehler-Jarvis. (1) A large and complex Calrod element is die-cast in exact position. (2) Metal cross sections are controlled to insure even heating across the pan. (3) A die-cast seal excludes wash water from the heating element.

The frypan is a highly successful die-cast product...millions having been produced to date.

In addition, Doehler-Jarvis makes parts for the

following Sunbeam appliances sold throughout the world:

| | |
|---|---|
| Mixmaster, Jr. | Butter Churn |
| Mixmaster | Clipmaster & Shearmaster |
| Men's Shaver | Model "S" Sprinkler |
| Electric Drill | Blender |
| Food Chopper | 21" Rotary Lawn Mower |
| Hedge Trimmer | Egg Cooker |
| Slicer & Shredder | Bench Grinder |

Doehler-Jarvis, possessing the world's most extensive die-casting facilities, has met Sunbeam's large-volume requirements with the desired quality and service. We are proud of our long association with the Sunbeam Corporation.

Doehler-Jarvis Engineers, if anyone, can help you convert your product ideas into best sellers through die castings. Get in touch with them—now!

**Doehler-Jarvis**

**DIVISION OF NATIONAL LEAD COMPANY**

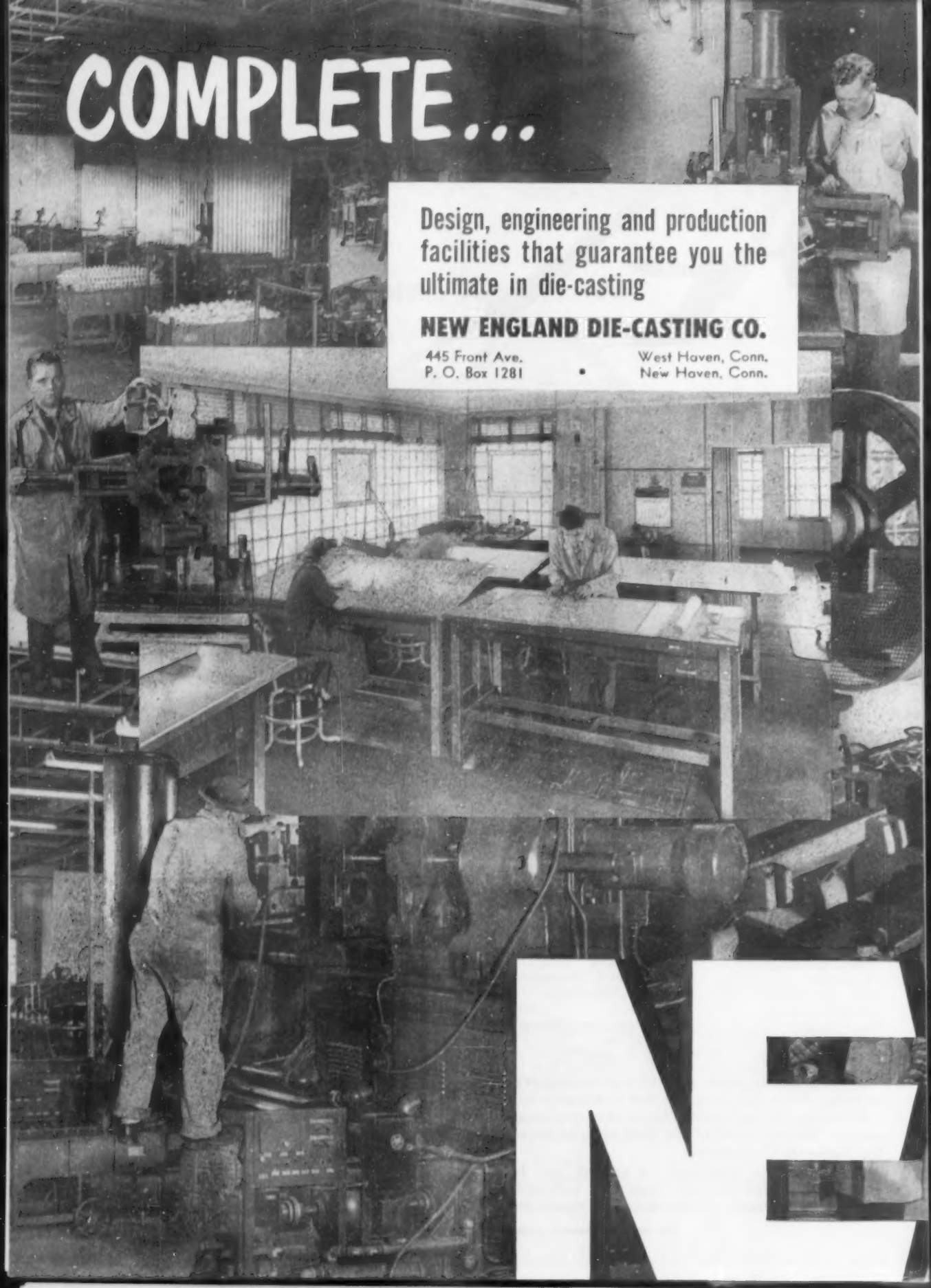
General Offices: Toledo 1, Ohio

In Canada:

**Barber Die Casting Co. Limited**

Hamilton, Ontario

*For more information circle No. 51 on the Reader Service Card*


COMPLETE...
Design, engineering and production facilities that guarantee you the ultimate in die-casting
NEW ENGLAND DIE-CASTING CO.
445 Front Ave.
P. O. Box 1281
West Haven, Conn.
New Haven, Conn.
NE

# Eight Jobs That Cost Less By Powder Metallurgy

THE growing intricacy of modern mechanical devices has brought with it the need for more and more skilled workers in both manufacturing and assembly. Along with this demand has come a shortage of these skilled workers and hence a greater than normal increase in wages and wage demands. The manufacturer is forced continually to seek methods of manufacturing that will lessen or eliminate the need for skilled mechanics without sacrificing either service or performance characteristics.

In the group of manufacturing processes to which recourse may be made is powder metallurgy. With this technique, practically all skilled labor is eliminated after the tooling has been made. Physical properties can be varied over such a wide range that there is little danger of reduced performance characteristics. In fact, due to some characteristics that are unique to parts made from metal powders the service life of these parts is often increased.

Not all parts are amenable to manufacture by powder metallurgy techniques, but where the process can be applied, the savings in both man hours of labor and in materials is often spectacular. The following eight cases of conversion, from the files of the Lux Clock Co., may be considered as entirely typical where powder metallurgy is properly applied.

**CASE NO. 1**
Ratchet

The ratchet assembly, left, was replaced by a powdered metal part, right, and proved to be a definite step in the reduction of cost and better operation of the mechanism where it is used.

The former method of manufacture was to turn the ratchet on the automatic machine, then to pierce the small hole and also burr the hole, making three operations on the part. A small pin was also turned on the automatic machine and the operation of assembly was then done. Extruded rod was used for the ratchet, which presented a higher material element. The automatic element alone represented 3.8 hours per/M.

| OLD | NEW |
|---|---|
| 8.2 hours per/M | 0.5 hours per/M |
| $3.19 material cost/M | $.31 material cost/M |

**CASE NO. 2**
Roller

This roller, made from powdered metal, does not look like a very important part, but was troublesome and expensive to make the old way. Prior to the use of powdered metal the procedure was to turn a brass roller bushing and blank out a shell which had to be centerless ground and hardened. These two parts were then staked together and trimmed. Old assembly is shown complete with shaft, left.

The powdered metal part, right, gives the hub and the roller with slot all at once; centerless grinding and hardening are eliminated.

The costs to produce these parts:

| OLD | NEW |
|---|---|
| 4.1 hours per/M | .24 hrs. per/M |
| $1.62 material per/M | $.44 material/M |

For more information circle No. 52 on the Reader Service Card

EIGHT JOBS
THAT COST LESS — continued

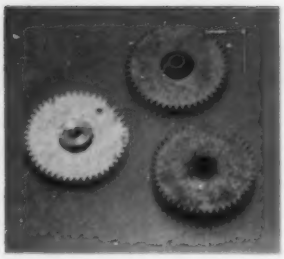
**CASE NO. 3**
Timer Cam

When the timer cam for a dryer was originally produced, it was assembled from a number of parts, held together by staking and a snap ring. Besides being a laborious (although small) piece to assemble, calling for great skill, this dryer timer cam, left, resulted in a great deal of spoilage. The comparative figures given below do not reveal the hidden savings which have come about by the elimination of scrap losses and wasted labor.

Here is a comparison of operations and parts required previously, along with the simplified method now used.

| OLD<br>Assembly Operations Eliminated | Hours | Material |
|---|---|---|
| 1800 Cam Assembly Complete | | |
| Assemble Cam washer and stake | 3.15 | |
| 1800 Cam First Assembly | | |
| Assemble key washer and stake | 3.15 | |
| Final Assembly | | |
| Assemble Friction ring, 1600 Cam Hub and pin | 2.25 | |
| Drive pin | 2.42 | |
| Clip Keyway | 2.57 | |
| Parts Eliminated | | |
| 1600 Cam Hub | | 7.15 |
| Turn | 1.0 | |
| Drill with jig | 3.61 | |
| Burr hole (2 sides) | 1.50 | |
| 1660 Cam Hub Pin | | .05 |
| Turn | 1.00 | |
| 1800 Key Washer | | .25 |
| Blank & Pierce | 0.14 | |
| 1800 Cam Washer | | .25 |
| Blank & Pierce | 0.12 | |
| Nickel Plate | | |
| 1800 Cam Spacer | | 2.50 |
| Turn & Chamfer | 1.0 | |
| Snap Ring (Purchased) | | 1.00 |
| | 23.2 | 11.23 |
| **NEW** | | |
| 1800 Adapter Hub | | .90 |
| Mold | 0.4 | |
| Sinter | 0.24 | |
| | 0.64 | .90 |

Savings: 22.5 hours to produce/M
$10.33 material per/M



**CASE NO. 4**
Fourth Wheel

Prior to being made from powdered iron, this fourth wheel, left, was composed of a turned brass hub and a hobbed tooth brass wheel which were staked together. This gear was also reamed and burred for proper fit.

It is now made in one pressing operation, right, with the rise in the center which replaces the hub. When staked to the shaft the possibility of loose hubs is eliminated and the wheel truing is not required.

| OLD | NEW |
|---|---|
| 7.2 hours per/M | 1.9 hours/M |
| $6.80 material per/M | $.73 material per/M |

**CASE NO. 5**
Center Pinion

The former method of making this center pinion, left, was to turn a brass pinion shuck, then to drill eight needle holes, fill the holes with wires and close them in. Due to the trouble with holes being off line and improper closing pressure, these parts were subject to 100 percent inspection and the spoilage element was a costly one.

By the use of powdered metal a more satisfactory part, right, is obtained both from the cost angle and operation of mechanisms.

| OLD | NEW |
|---|---|
| 4.3 hrs. per/M | .45 hrs. per/M |
| $2.14 material per/M | $.13 material/M |

**CASE NO. 6**
Verge Assembly

One of the more complex shapes to be converted from a multiple-piece assembly, left, to a powdered metal part, right, is this alarm verge assembly. The simplicity of the powder metallurgy process, compared with a combination of punching, machining and assembling operations, is very well illustrated by this change-over.

Analysis of each of the two methods of fabricating is given right.

**OLD**

| Part Name or Operation | Hrs/M | Material |
|---|---|---|
| Lever .055 Brass | | 3.16 |
| Blank Spot Pierce | .30 | |
| Drill Shaft Hole | 1.08 | |
| Drill Stop Pin Hole | .94 | |
| Verge Pins (Purch.) (2) | | 1.00 |
| Hammer Head .250 Sq. Steel | | .75 |
| Turn (B/S 300) | 2.50 | |
| Degrease | | |
| Lever Screw .125 Hex Steel | | .27 |
| Turn (B/S 300) | 1.90 | |
| Nickel Plate | | |
| Assembly Operations | | |
| Drill 1st Pin Hole | 1.20 | |
| Drill 2nd Pin hole | 1.20 | |
| Drive 2 Verge Pins | 3.82 | |
| Position 2 Verge Pins | 1.58 | |
| Stake Hammer Head | 1.38 | |
| Tap 1 Hole | 1.45 | |
| Assem. Screw | 2.98 | |
| | 20.3 | 5.18 |

**NEW**

| Operations | Hrs/M | Material |
|---|---|---|
| | | .47 |
| Mold | 0.51 | |
| Sinter | 0.32 | |
| Tumble | — | |
| Oil Impregnate & Spin off oil | — | |
| | 0.83 | .47 |

Difference 19.5 hours/M
$4.71 Material/M

**CASE NO. 7**
Center Pinion

Methods of making the center pinion have been greatly improved. Due to the manner of making the pinion previously, left, great variations could occur and a 100 percent inspection was required. This has been eliminated due to the complete uniformity of powdered metal pinions, right.

As formerly produced, the pinion was turned on an automatic machine. Then, the pinion was constructed by drilling small holes around the pieces and inserting eight needle wires. After the holes were closed, each pinion had to be inspected. Now, the powdered metal parts are made in one piece and, since there is no variation from piece to piece, the inspection is unnecessary.

| OLD | NEW |
|---|---|
| 4.3 hours per/M | 0.4 hours per/M |
| $4.00 material per/M | $.55 material per/M |

**CASE NO. 8**
Stop Gear

By replacing a three-piece assembly, left, with a one-piece powdered metal minder stop gear, right, the company saved a number of operations, cut production time drastically, and cut materials costs to less than 10 percent of the original.

This gear, typical of many such small components having one or more elements that cannot be formed in the same operation that is used to form the basic shape, suggests places that powder metallurgy could be put to good use in manufacture of instruments and mechanisms having precision gear trains.

| OLD | NEW |
|---|---|
| 8.7 hours per/M | 1.0 hours per/M |
| $3.20 material per/M | $.30 material per/M |

**To find out why the aircraft industry is using so many forged, machined and welded steel components when castings would be more economical, the Government made an investigation into . . .**

# The Prospect For Precision Steel Castings In Aircraft

THE aircraft industry has been a major user of investment castings; it was this industry's need for high precision components in complex shapes and hard-to-form alloys that led directly to the development of modern investment casting techniques, from an ancient craft, during and since World War II.

The investment casting industry has, in fact, grown along with the aircraft industry. Refinements in foundry practices, new techniques for quality control and thousands of hours of development work have gone into the production of aircraft quality castings. Investment castings in a wide variety of alloys are being used in today's aircraft for components ranging from cobalt and nickel alloy jet engine parts to aluminum instrument housings.

But one important fact stands out: despite the large number of investment castings being used, a still greater number of components having shapes that might be expected to be cast are, instead, being forged or machined

## COMMON ALLOYS USED

| MATERIAL | IN THE AIRFRAME | | IN THE ENGINE | |
|---|---|---|---|---|
| | Castings | Forgings | Castings | Forgings |
| IRON | (Not Available) | None | AMS 5392D, "Ductalloy" | None |
| ALLOY STEELS | AISI 4130, 4140, 4340 | AISI 4130, 4140, 4340, 4625, 8630, 8740 | None | AISI 4130, 4340, 4640 8740, 9315 |
| CHROME STAINLESS STEELS | AISI Types 410, 416, 431 | None | AISI Type 410 | None |
| OTHER STAINLESS STEELS | AISI Types 303, 310 | AISI Types 303, 347 | AISI Types 310, 316, 347, 17-4-PH, 17-22-AS | AISI Types 309, 316, 321, 347 |
| HEAT RESISTANT ALLOYS | None | None | Stellites 21, 30, 31 | Hastalloy B, S-816 "Multimet" |
| ALUMINUM ALLOYS | Alloys 13, 195T, 220, 355, 356 | AA 2014 (14S, R301 Core), 2017 (17S), 6151 (A51S), 6061 (61S), 7075 (75S) | Alloys 355, 356, 360 | AA 2014 (14S, R301 Core), 2018 (18S), 2025 (25S), 4032 (32-S), 6151 (A51S), 6061 (61S) |
| MAGNESIUM ALLOYS | AZ92A, AZ91B, AZ63A, AM 100A | AZ61A, TA54A, AZ80A | AZ92A, AZ63A, Z5Z, AZ91B, AZ92A ZRE1 | Not Available |
| COPPER BASE ALLOYS | QQ-B-691b(-1), Comp. 8 SAE 430A & B | None | SAE 49, 62, AMS 4846A, 7322A, 7320A, QQ-B-691b Comp. 7, QQ-B-671b. C1, 3 | AMS-4614D, 4619B, 4630D, 464OC. |
| TITANIUM ALLOYS | None | AMS 4925 | None | None |

from the solid. To find out why the highly economical casting methods are not being used more extensively and to determine what steps, if any, can be taken to expand their use in the manufacture of aircraft, the government has made a detailed study of the problem.

Findings of a panel, set up by the Materials Advisory Board "to make a survey of the field of high-strength precision casting techniques *with particular emphasis on steel* to ascertain if there is promise of developing, through research, methods of producing castings which would be more widely usable in aircraft construction" have recently been published*. This study is not confined strictly to investment castings, but encompasses other types of "precision steel castings" such as shell molding, Ceramicast and "various other new mold-making processes," comparing these with forgings, pieces "hogged" from bar stock and weldments.

Reasons stated for concentrating the study on steel are: 1) current limited use of steel castings, particularly in the airframe, 2) new developments in extrusion and forging aluminum and magnesium that may be more promising than precision casting for such metals, 3) temperature ranges to which major portions of future aircraft structures will be subjected may limit use of aluminum and magnesium alloys and even titanium at higher ranges, 4) strength-weight ratios on basis of currently attained tensile strength give steel a decided advantage over aluminum and magnesium casting alloys.

The following material is extracted from the OTS report, with regard to the present situation, points of view of aircraft designers and foundries, a discussion of what is needed, and a series of recommendations.

**ANALYSIS OF THE PROBLEM.** Under present and forseeable development of the casting art, it is not possible to attain, except in very small pieces, dimensional tolerances and surface finishes of such exactness as to eliminate subsequent refinement of the matching surfaces needed for close-fitting assemblies. On the other hand, there is a great advantage in producing by casting, tolerances and finishes on nonmatching surfaces of such accuracy as to make machining unnecessary.

Many aircraft parts are now rough machined or "hogged" from bar stock to final shapes sometimes weighing only 10 percent of the weight of the original stock. Other parts can be forged only roughly to the required shape and require considerable machining. Still other parts are fabricated of complex and costly welded assemblies. Many such parts might logically be redesigned as castings which could be produced to

*Continued next page*

*Precision Steel Castings for Aircraft Use*, distributed by the Office of Technical Services, U. S. Department of Commerce, (PB121148), price $1.75. Data and charts presented here are based on this report.

## STRENGTH COMPARISONS, CAST VS. WROUGHT

| MATERIAL | CASTINGS | | | FORGINGS | | |
|---|---|---|---|---|---|---|
| | Alloy | Ult. Tens. Str. | Elong. | Alloy | Ult. Tens. Str. | Elong. |
| CARBON STEEL | SAE 1025 | 75,000 psi | 24% | SAE 1137 | 90/100,000 psi | 14% |
| ALLOY STEEL | AISI 4130<br>AISI 4340 | 200/220,000<br>260/280,000 (Experimental | | AISI 4340 | 260-300,000 | 10% |
| STAINLESS STEELS | | | | | | |
| 300 SERIES | AISI Type 347 | 80,000 | 33% | AISI Type 303 | 100,000 | 35% |
| 400 SERIES | AISI Type 410 | 160,000 | 20% | AISI Type 410 | 190/200,000 | 15% |
| SPECIAL | Armco 17-4PH | 180,000 | 7% | | | |
| HEAT RESISTANT ALLOYS | (Typical) | 46/56,000[1] | | (Typical) | 56,000[1] | |
| ALUMINUM ALLOYS | 356T6 | 35/45,000 | 4% | 75-S | 70/80,000 | 7% |
| MAGNESIUM ALLOYS | AZ92A | 35/40,000 | 3-7% | AZ80A | 42/48,000 | 2-5% |
| TITANIUM ALLOYS | | None | | RS 130 | 140,000 | 10% |
| GRAY IRON | AMS 5392D | 25/30,000 | | | None | |
| NODULAR IRON | "Ductalloy" | 100/120,000 | | | | |

[1] 1200 F, rupture stress after 1000 hours. Typical fatigue strength at 108 cycles and 1200 F for castings and forgings are 60/65,000 psi.



dag 'dag' dispersions... *a touch does so much!*

'Aquadag' Succeeds

## WHERE CASTINGS ARE NOW BEING USED . . .

A list of typical castings produced for aircraft use by precision processes —

**OF NODULAR IRON**

Center main bearing support for J-65 engine; weight 155 pounds; largest diameter 36 inches.
Compressor housing for J-71 engine; weight 100 pounds; diameter of semi-circular shell 34 inches.
Combustion chamber support; diameter 30 inches.
Air valve body; weight 28 pounds; diameter 10 inches; length 18 inches.

**OF ALLOY STEEL**

Propeller Hub (4130), weight 30 pounds, 5½" dia x 11".
Hydraulic brake backing plates, (17-22AS), weight 10-20 pounds, diameter 12-20 inches.
Jet engine bracket (4130), weight 12 pounds.
"JATO" bottle hook (4130), weight 10 pounds.
Bearing support for Wright engine (4130), weight 10 pounds.
Carrier assembly (SAE 8730), weight 12 pounds, 7" x 7" x 9".

**OF STAINLESS STEELS**

**400 Series** — Turbine ring for jet engine; weight 48 pounds.
Rear turbine bearing, weight 35 pounds.
Helicopter cargo hook (17-4PH), weight 10 pounds, 2½" x 4" x 14".
Outer shroud ring for J-57, weight 20 pounds, diameter 12-14 inches.
Jet engine support ring, weight 35 pounds, diameter 15 inches.
Parachute canister loading unit, weight 100 pounds, diameter 20 inches.
Sway brace case (410), weight 28 pounds, height 20 inches, diameter 8 inches.
Small investment castings such as latches, hooks, and pawls.

**300 Series** — Jet burner ring, weight 16 pounds, diameter 16 inches.
Jet trunnion post, weight 21 pounds, 16" x 9".
Jet bearing support, weight 29 pounds, 15" x 18".
Turbo-hood shield (347), weight 13 pounds, diameter 16 inches.
Turbine manifold, weight 34 pounds, diameter 16 inches.
Entrance stator nozzle for J-33, weight 2 pounds.
Compressor vanes, weight 1 pound.
Exhaust fittings, weight 1 to 2 pounds.
Supercharger wheel, diameter 17 inches.
After burner ignition fuel valve, weight 12 pounds, length 6 inches.

**OF ALUMINUM ALLOY**

Diffusor for aircraft supercharger, weight 26 pounds, diameter 23 inches.
Regulator housing for variable pitch propeller.
Assembly, weight 9 pounds, diameter 14 inches.
Aircraft brake, weight 10 pounds, length 12 inches.
Magneto housing, weight 9 pounds, diameter 8 inches.
Throttle lever, weight 1 pound, length 12 inches.
Casting housing, coordinator, weight 1¼ pounds.
Canopy release, weight 3 pounds.

**OF MAGNESIUM ALLOYS**

Compressor case for J-48 engine, weight 132 pounds, diameter 50 inches.
Leading edge of stabilizer fin for C-V Crusader.
Aileron leading edge for Lockheed, weight 13 pounds, length 7'6".
Window seal for McDonnell Banshee, weight 6 pounds.
Speed brake for Chance Vought "Cutlass", weight 30 pounds, 3' x 2½".
Aircraft wheels.
Engine plug air ring for B-36, diameter 50 inches.
Tail piece stabilizer, weight 12 ounces.
Impeller for GE engine, diameter 6 inches, length 3⅛ inches.



conform closely to the dimensions desired in the finished parts. Obviously, it is possible also to design castings originally to fit certain space-weight-strength requirements.

In the design of castings, it is necessary to compromise between securing final shapes and finishes "as cast" or through subsequent machining. The deciding factor will be cost, stated in terms of either manpower or dollars. Thus, the function of a so-called "precision casting" process may only be to produce castings of an intricate shape which, although not to desired dimensional tolerances, will still be more economical than machined forgings, pieces "hogged" from bar stock or weldments. A further advantage accrues in competition with "hogged out" pieces in which the directional properties of the original wrought bar often are unfavorable to critically stressed portions of the finished parts.

In the opinion of the panel, the attainment of dimensional accuracy and fine surface finishes is secondary to the importance of securing consistently good mechanical properties in steel castings intended for Class IA aircraft components.

**PRESENT SITUATION.** Quantitatively present usage of steel castings in aircraft is very limited. (List at left). A few large sand castings are used as auxiliary structural parts, precision castings of intermediate size (8-30 pounds) have important special applications in modern jet engines and as auxiliary parts of the airframe. A large number of small (under two pounds) investment castings are used for accessories, plumbing and hardware components.

At present, no steel castings are being used as structural components of airframes. The panel report points to reasons for hesitancy of aircraft manufacturers to use steel castings in critical applications. Fear arising from past experience with unsatisfactory lots of castings, the quality and mechanical properties of which have shown wide variations, is the principal factor. In addition and largely as a result, current aircraft specifications provide lower allowable design

*Continued on page 86*



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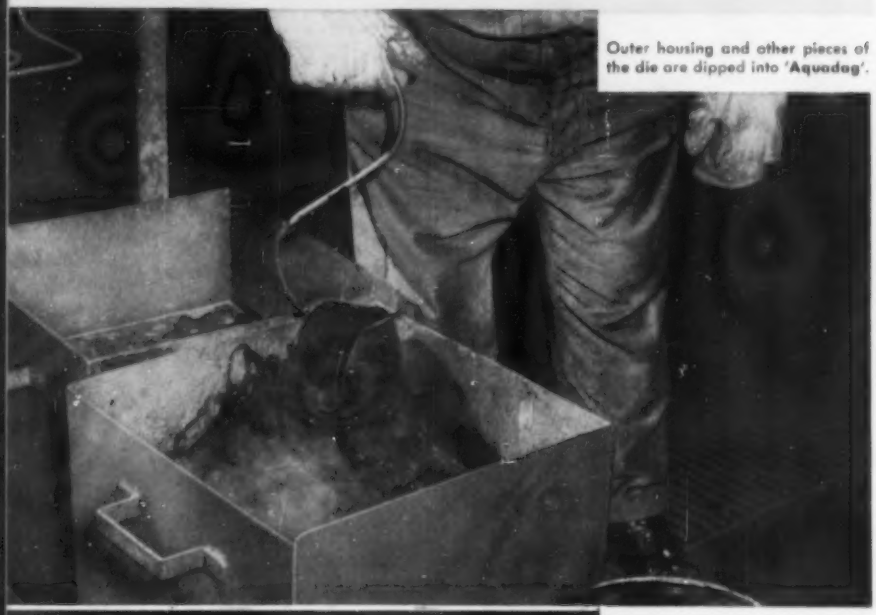

Outer housing and other pieces of the die are dipped into **'Aquadag'**.

Outer housing of die with finished casting ready for removal. Press will force casting from mold.

Castings after removal from mold.

## 'Aquadag' Succeeds Where Others Fail...

*Reports Diehl Manufacturing Company*

When molten aluminum at 1300-1400 degrees F. is poured into a centrifugal mold spinning at high speed, an exceptionally durable parting compound must be used. **'Aquadag'** has been satisfying this need for 14 years in a centrifugal casting operation at Diehl Manufacturing Company, Electrical Division of the Singer Manufacturing Company, world-renowned makers of Singer Sewing Machines. Other products have been tried, but without success.

Diehl reports that **'Aquadag'** pays off in three ways:

**By speeding production**
**By increasing mold life**
**By producing better castings**

**'Aquadag'** protects the mold against the impact of high-velocity molten aluminum. It prevents aluminum from adhering to the die, and protects the purity of the castings by preventing iron transfer from the mold to the aluminum melt. One application of **'Aquadag'** lasts for at least six castings, which are produced at the rate of about one per minute per machine.

Write for Acheson Bulletin 425 on Metal Casting Operations for practical information on product improvement and lower costs in your own shop. The Acheson Service Engineer in your area will be glad to consult with you.

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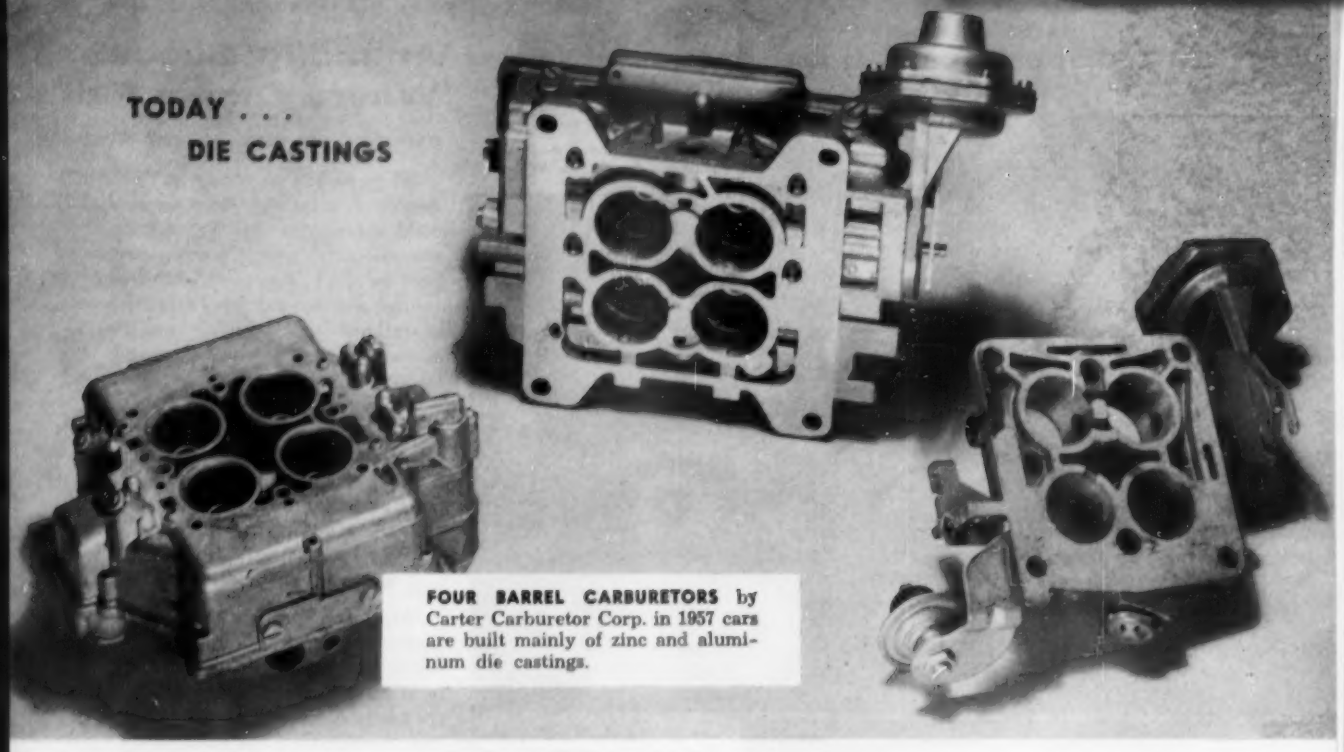
TODAY . . .
DIE CASTINGS



**FOUR BARREL CARBURETORS** by Carter Carburetor Corp. in 1957 cars are built mainly of zinc and aluminum die castings.

**Complex carburetor shapes would have been tough to make in big quantities if it were not for die casting; now, most producers of fuel injectors will follow this example by using die cast components.**

# Is There A

ONE of the "hot" subjects in automotive circles today is fuel injection. While not new in its basic concepts, this method of feeding fuel to an internal combustion engine is new as applied to mass produced automobiles.

The advantages to be gained from the use of fuel injection are many. While each individual gain may be relatively small, the overall gain can be impressive. The feeling in the automotive industry is that this may be one of the most significant advances in internal combustion engine design that has occurred in the last two decades. One prominent manufacturer has said that the successful application of fuel injection may well delay for an indefinite period, the conversion to gas turbines as motive power for automobiles.

**WHAT IS IT?** Basically, fuel injection is a system for supplying a completely uniform, controlled composition, combustible mixture to each cylinder. The common complaint of starving end cylinders and feeding too rich a mixture to center cylinders will be eliminated.

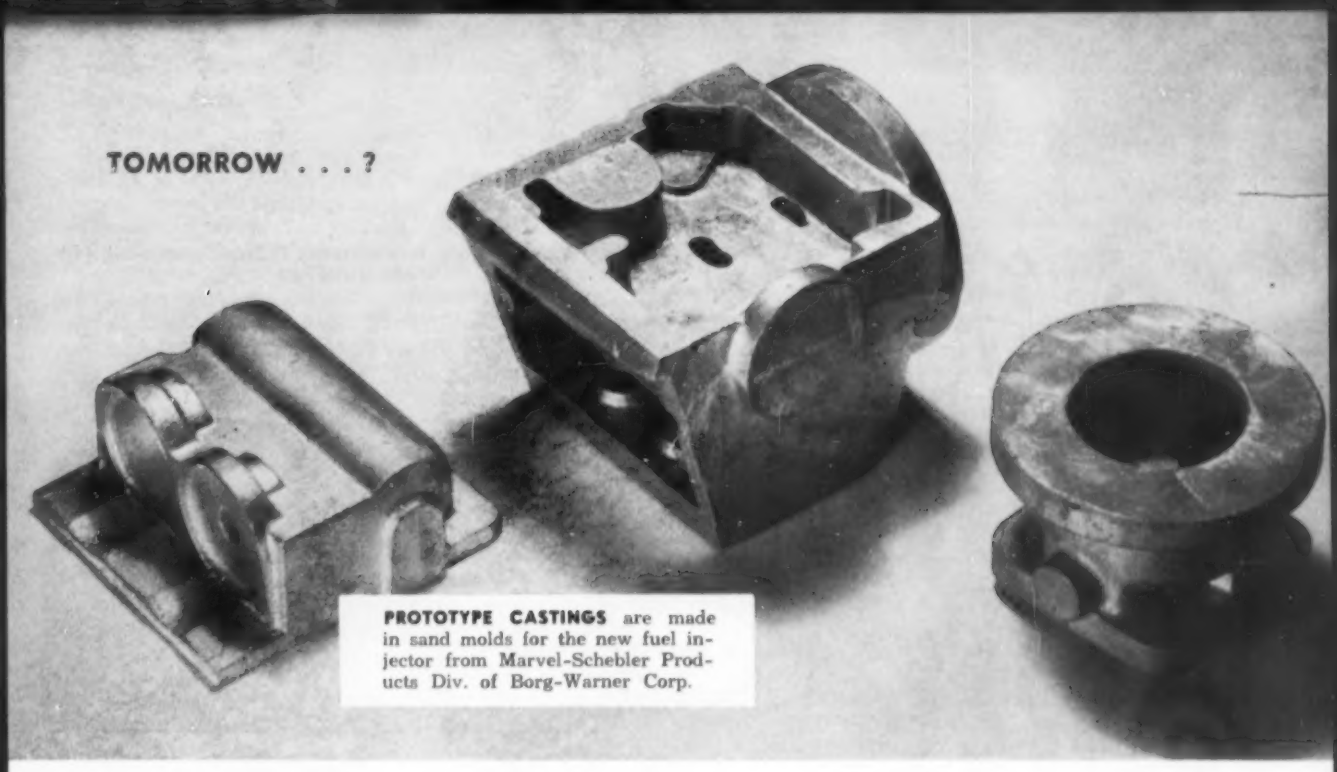
Although this new application of fuel injection will be used in place of the conventional carburetor, the basic function of both units is the same — that all-important job of providing the proper mixture of fuel and air to the engine cylinders.

However, fuel and air are mixed in the carburetor itself in a carbureted fuel system and the mixture then is fed through passages to each cylinder. In a fuel injection system, the fuel and air are fed separately to each cylinder and then mixed just before entering the cylinder's combustion chamber where the actual ignition takes place. This insures more equal distribution of the combustible fuel-air mixture to each cylinder.

The time delay required to purge the manifolds and replace with a different gas-air mixture is eliminated. Manifolds can be designed for the best air flow without having to consider the effect of suspended fuel particles.

The need for a hot spot in the manifold to heat the fuel-air mixture during warm-up will be gone and warm-up periods in cold weather will be materially lessened.

Other advantages to be gained are improved fuel economy, increased engine output and torque at lower engine speeds, elimination of icing, elimination of vapor lock, reduced stalling tendencies on turns, hills and sudden stops, and rapid fuel cut-off during deceleration.




**PROTOTYPE CASTINGS** are made in sand molds for the new fuel injector from Marvel-Schebler Products Div. of Borg-Warner Corp.

# Fuel Injector In Your Future?

As presently envisioned, there will be at least two distinct injection systems. When applied to new cars, the fuel will be injected into either the manifold or the ports directly ahead of the combustion chamber. When applied to older cars a system is available where the injector simply replaces the present carburetor and air filter — this system is strictly for the replacement market.

Both of these systems are said to give all of the advantages noted above. In addition, direct injection allows the placement of the air cleaner at any desirable spot instead of directly over the carburetor as is now required. This will permit the intake of cooler, and hence larger volumes of air at operating temperatures, and the lowering of the hood line by about six inches or more.

**WHEN WILL IT BE USED?** Some cars will make a fuel injection system available on the 1957 models as an extra — possibly a fairly expensive extra. By 1958 all cars are expected to have this system available, as standard equipment or as an extra.

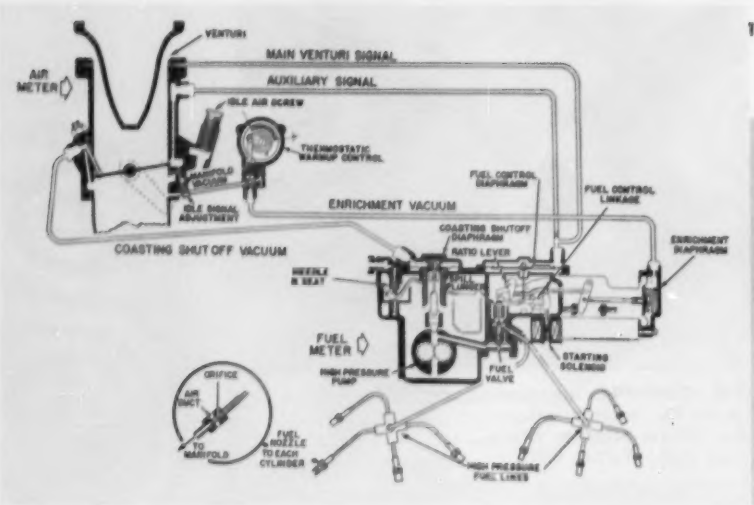
While no one will make any predictions ahead of 1958, the demand for lower silhouettes may very well force the adoption of fuel injection on all new cars within the next two or three years so that the hood line can be materially lowered.

**WILL THEY BE DIE CAST?** All of the companies who are known to be working on a fuel injection system expect to use die castings for the larger, major components of the system. These will include functional members, housings, control items, etc. While present prototype models are being made from sand castings, no method of manufacture other than die casting is being considered for the production models.

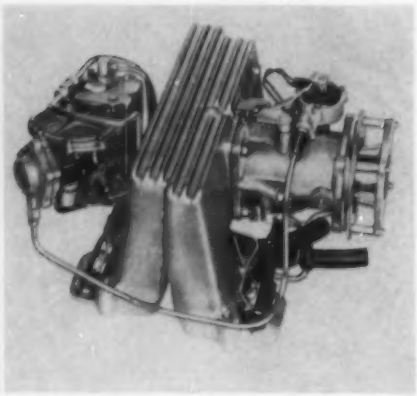
Which metal will be used is still undecided. Since all of the systems now under consideration and development can utilize aluminum, magnesium or zinc, it is probable that the final decision will be

*Continued on page 111*

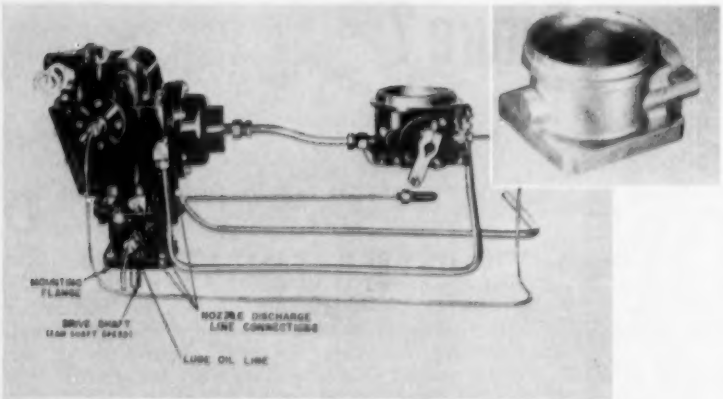
***THREE FUEL INJECTION SYSTEMS THAT ARE IN OR NEARING PRODUCTION***

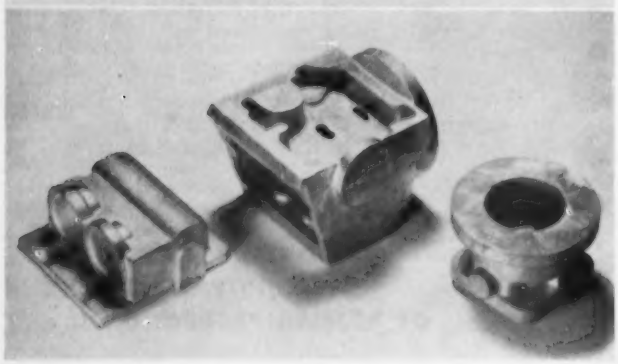



**1. THE GENERAL MOTORS FUEL INJECTOR**



**2. THE BORG-WARNER FUEL INJECTOR**



THE injection system developed by the Marvel-Schebler Products Div. of Borg-Warner Corp. is designed to inject fuel into the air stream at the combustion chamber intake ports. All of the advantages of fuel injection, including lowering of the hood line are possible.

In addition to the fuel injector and the throttle body illustrated, a fuel pump and filter will also be used in this system. The prototype sand castings for the injector and throttle body are shown. Notable is the fact that all of the castings shown are far simpler in design than current carburetor castings.

The final castings of these parts will be either aluminum or zinc die castings. The total weight of the finished castings shown here will be slightly less than the castings they will replace, but some cover and control components not shown will probably bring the weight up to about the same as a typical four barrel carburetor casting assembly. The actual weight will be more than that of a two barrel carburetor.

The problem of casting porosity that has plagued the carburetor manufacturer will no longer be of any great moment. Good commercial grade castings are expected to meet all needs.

THE fuel injection system developed for the 1957 Chevrolet is of the continuous flow type as shown by the schematic layout. In this system the gasoline is sprayed through calibrated nozzles at the entrance of each intake port. According to the manufacturer, Rochester Products Div. of General Motors Corp., the system has two major advantages over carbureted fuel systems. These are:

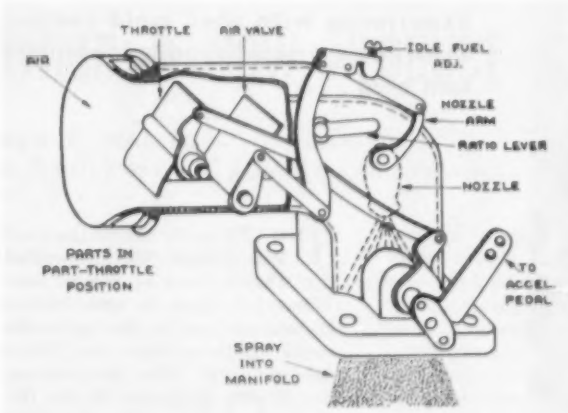
1. Since fuel is piped to each cylinder, manifold design does not affect fuel distribution.
2. Since the manifold supplies air only, it can be designed to provide the best possible operational characteristics for power and performance. It further allows the positioning of the air filter where it can take in the coolest air and occupy the least space.
3. Other advantages claimed are lower sensitivity to turns and inclines, a fast warmup, no icing and fuel cutoff in deceleration.

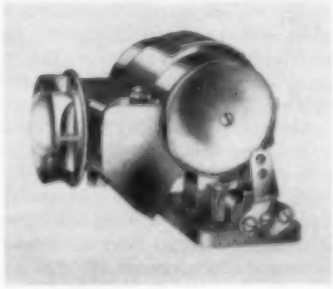
The probable appearance of the unit and the castings that will comprise it are clearly shown in the illustration. These castings will all be aluminum or zinc die castings. How final weights of castings will compare with a carburetor casting is not known.

For the most part, the individual castings will probably be of simpler design so that production rates will be higher and rejects lower than with carburetor castings. Over-all tooling costs may also be lower for these castings. Probably eight or more different die castings will be used in this injector.

The Rochester continuous flow fuel injection system differs from the timed injection system used by the Diesel engine in which the fuel is injected directly into each cylinder by a plunger.

Technically, the continuous flow system operates in the following manner: Air is fed to an air meter and is metered past a throttle valve, controlled by the position of the accelerator pedal, into the manifold passages which feed each cylinder of the engine. As the air flows through the air meter, a signal is transmitted to a fuel meter which, in turn, determines the proper amount of fuel to be fed to the cylinders. The metered fuel is fed to eight nozzles, each located in the manifold passage just ahead of the intake valve. Here the fuel and air are mixed and are available at the instant the intake valve opens. The combustible fuel-air mixture then enters the cylinder of the engine.





3. THE SAATY FUEL INJECTOR

THE fuel injector system developed by the Saaty Fuel Injector Corp. is designed almost exclusively for the replacement market. According to the manufacturer, by eliminating the venturi which serves to draw fuel into the air stream with a fuel supply under positive and constant pressure most of the advantages of fuel injection can be realized.

Space saving is, of course, not a problem in this case since this unit is designed to replace the present carburetor and still feed fuel into the manifold as is now done.

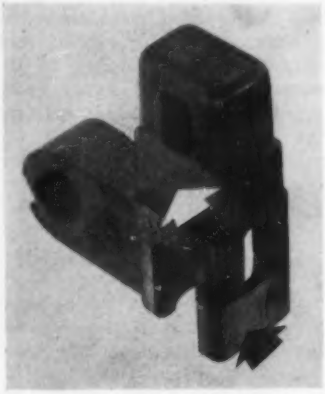
Illustrated are the complete injector and the main castings used in it. This zinc die casting weighs and costs considerably less than a present day carburetor.

In contrast to a carburetor casting, this injector body has only one critical dimension. So that the air control butterfly valve will seat properly and work easily the side walls for a distance of about 7/8" must be cast with zero draft on the core.

*Continued on page 85*

*More than 125 components in the new Masterlith Duplicator are produced by shell mold casting in iron, aluminum and bronze.*

**3 REASONS FOR USING SHELL MOLD CASTINGS**



**SHALLOW CUTS,** such as indicated by arrows, are possible because there is no "skin" to be removed from these shell mold castings, as there is with sand castings.

## Experience with shell mold casting shows how a new foundry technique can help . . .

THIRTY years before the Civil War, John C. Whitin founded the Whitin Machine Works, near Worcester, Mass., to manufacture his patented picker for use in the cotton mills of the area. Now celebrating its 125th anniversary, the Whitin Machine Works has grown from the status of a local equipment supplier to become one of the leading manufacturers of textile preparatory machinery both in the United States and abroad.

Although 1956 marks 125 years in building textile machinery, it is also the first year of a completely new venture for the company. Early in 1955 the Whitin Machine Works announced that it would commence production in 1956 of a new product in the business equipment field.

While seemingly a complete departure from its usual role, Whitin had logical reasons for the move. Whitin had grown to a position of leadership in its field but opportunities for any large scale

**50 PERCENT LESS TIME** is spent on machining because many operations can be reduced to simple rough drilling and reaming. Savings in cost of machining is estimated at 75 percent.

**IMPROVED PATTERN REPRODUCTION** is noted when blowing coated sand for shells having contours made as if cores were integral with the shell mold. Resin economy is also gained.

# When A New Product Is Born

**By R. C. WALKER,** Whitin Machine Works
**J. E. BOLT and J. F. SOMERS,** Chemical Materials Dept., General Electric Co.

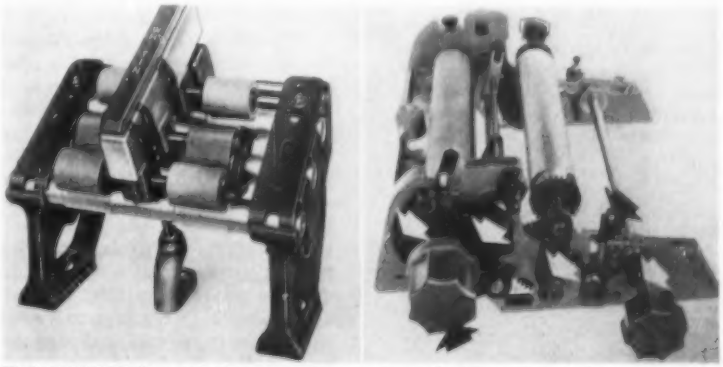
continuance of this growth in the textile field were diminishing. Diversification into a supplementary product line which could more efficiently utilize the company's skilled personnel and facilities was a logical move.

These assets include experience and equipment for the production of precision metal equipment for textile manufacturing. Also included was a foundry. After extensive consideration, the firm decided to produce and market what is now known as the Whitin Masterlith Duplicator.

With the advent of the shell-molding process, Whitin had begun a program of development in the textile field which resulted in the manufacture, by this process, of components for the "Unitrol" unit used on spinning frames. The success of this application convinced Whitin that shell molding definitely has a place in their manufacturing processes. It was natural, then, that the shell molding process be considered as a possible method for producing many of the cast parts for the new duplicator.

Engineering requirements, production needs, and long-range sales plans indicated that the duplicator provided many good applications for shell molded castings. Its design called for many precision parts where great reductions in machining operations would be valuable.

As a result, Whitin decided to cast more than 125 parts for the new machine of iron, aluminum, and bronze by the shell molding



**THE CHANGE** from textile equipment such as the Unitrol unit, left, which has a number of shell mold cast components, to the working mechanism of the Masterlith, right, was not difficult to accomplish. Some of the shell mold castings in the latter includes cams and gears (arrows) whose working surfaces are used with minimum of machining.

## THIS EQUIPMENT GIVES VERSATILITY TO WHITIN MACHINE WORKS' FOUNDRY

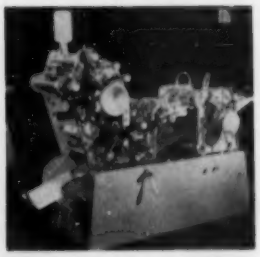
**FULLY-AUTOMATIC** two station shell molding machine is central production equipment for the shell mold foundry. Dry sand-resin mix is used.

**SINGLE-STATION** manually operated shell mold machine (mostly for development) and three core blowers are also used.

**CORES POSITIONED** in the hot shell halves are united using phenolic bonding resins.

**NO BACK-UP** is needed. Well-bonded shell halves are simply laid on dry sand for pouring.





*With outer housing off, this Masterlith Duplicator reveals complex workings.*

process. Many of these parts are illustrated.

Whitin's work was complicated by the urgency of getting the pilot production of machines into the field, coupled with initial limited production and assembly facilities. This was solved by making a single pattern for each part and grouping several patterns on a single pattern plate, so that complete sets of parts could be turned out in small numbers for the first production lines. As fast as production warrants, new equipment will be produced to keep step in the foundry with increasing demands of the assembly section.

The nature of its operations requires extreme accuracy of the Masterlith's working mechanism. Continuously operating at speeds of 3400-7200 sheets per hour, the mechanism must allow for exact "register" or positioning of each sheet during the duplicating process. Even under these exacting conditions some cam and gear working surfaces are used with a minimum of machining.

Whitin's Shell-Molding Department is now growing rapidly. At present the equipment consists of one two-station, fully automatic shell-molding machine, one small single-station manual shell molding machine used mostly for development, two shell-bonding machines, three core blowers designed for blowing coated sand and a complete unit for the cold

process resin-coating of sands.

Currently a dry mix of sand and resin is used for production of shell molds which are made on the two-station machines. Cores, positioned in the hot shell halves are united using phenolic bonding resin. Production speed is secondary to accuracy of core positioning and averages approximately 50 bonded shells per hour.

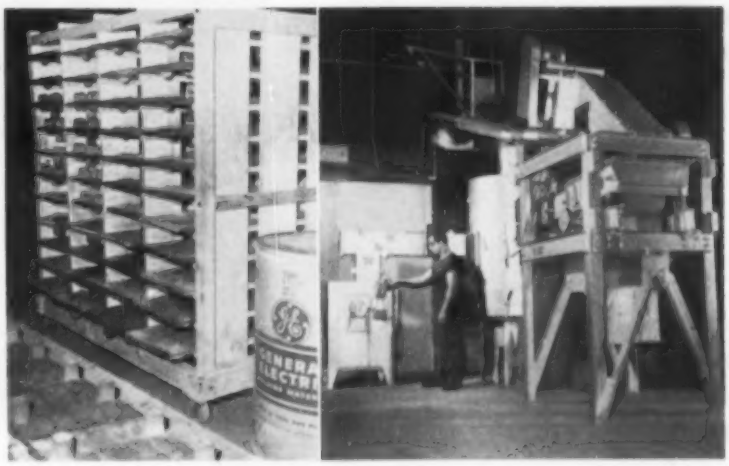
The bonded shells are stacked on wooden racks for rolling to the pouring station, or they may be stored for future use. Horizontal positioning and efficient bonding eliminate the necessity for back-up or elaborate positioning of the shells. Shells are merely positioned on dry sand before pouring. The entire shell-handling arrangement, from assembly to pouring, is now being mechanized.

Following shake-out, the castings are cleaned in a conventional cleaning machine reserved especially for shell mold castings using #120 grit. On aluminum shell mold castings, subsequent cleaning following shake-out is not necessary.

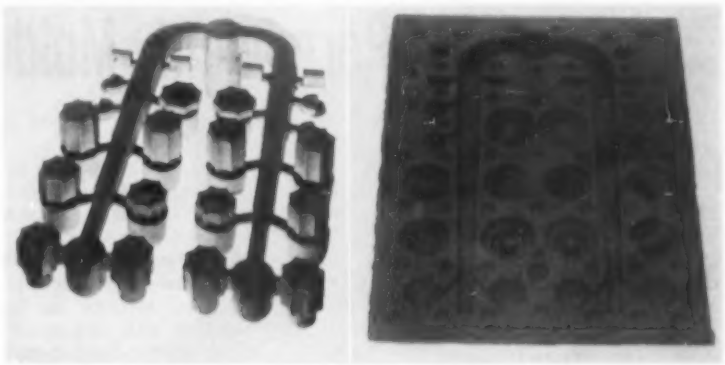
A typical shell half and string of aluminum castings for shell molds are illustrated. The gating employed is designed using principles developed for horizontal gating under American Foundrymen's Society sponsorship at Battelle Memorial Institute. This is a good example of successful production application and acceptance of fundamental development work underwritten by the AFS.

Whitin has been investigating the cold process for resin-coated sand for approximately 18 months. Newly installed coating equipment is capable of coating approximately 600 lbs. of sand per hour, which is used at present only for core production.

Experience at Whitin, in common with industry-wide findings, indicates the desirability of using coated sands entirely for both shell cores and molds. Experimental findings verify the advantages of "coated" sands, namely: freedom from resin segregation, less dust, resin economy and improved pattern reproduction. The latter is particularly helpful when blowing coated sand for shells having contours made as if cores were integral with the shell mold. Improved pattern reproduction has been experienced in such applications.



**BONDED SHELLS ARE STACKED** on wooden racks (left) ready to be rolled to the pouring station. If desired, they can be stored indefinitely and take up little space. New sand coating machine, right, can coat approximately 600 lbs. of sand per hour.



**GATING PRINCIPLES** developed by American Foundrymen's Society at Battelle Memorial Institute, are used in producing these castings.

With the availability of improved processing techniques, equipment, and resins Whitin expects to shift entirely to the application of coated sands for the blowing of shell cores, and expects to employ the blowing process for shell molds as well.

Based on development work to date the blowing of shell molds with coated sands allows for shells which are denser, smoother, better filled in difficult areas, and which require less resin than those made by present production methods. The ability to contour both sides of the shell mold allows for control of mold thickness to effect economy and to assist in controlling thermal gradients within the casting, and also allows for stacking of shell molds for pouring.

Another useful function shell molding can serve in a shop having both green sand and shell molding operations is in the reproduction of pattern pieces. This has been done at Whitin on a limited scale to date, and indications of success point out the desirability of increased activity in this area.

The cleaned castings stay on the premises where they merge with other parts for the Masterlith produced by various methods. These others may be die castings, fully machined, fabricated, or sintered powdered metal parts.

*Continued on page 91*

Eastern Casting Corp.

MOVIE PROJECTOR BASE

**Improved foundry techniques, plus the natural adaptability of the process, has proved to many designers that . . .**

# Permanent Mold Castings Can Be

DURING the past three years, use of aluminum permanent mold castings has more than doubled. The poundage cast increased from 146,900,000 pounds in 1953 to 295,600,000 pounds in 1955. These figures show that the trend toward mass-producing by the permanent mold process is keeping pace with the large increase enjoyed by die casting.

Contributing greatly to this rapidly increasing volume have been five specific factors.

1. Development of mass-production permanent mold casting techniques that enable high production rates.
2. Flexibility of operation that maintains production during periods of mold maintenance and during product modification.
3. High degree of adaptability to a wide range of product design.
4. Improved metal structure offering superior strength, dimensional accuracy, pressure tightness and machining qualities.
5. New finishes that add color, surface durability, high polish, and corrosion resistance to castings, plus improved general finishing qualities.

**LONG RUN JOBS.** Many improvements in foundry equipment and techniques have resulted in higher production rates for permanent mold castings, making them competitive with other high volume casting methods. While the old dip-and-pour method which accounted for the lag in casting rates is still commonly used, many foundries have found ways to speed the casting cycle and, in some cases, have developed ingenious permanent mold casting systems that are virtually automatic. Others have introduced air and hydraulic cylinders to eliminate time-consuming manual operations, such as opening and closing molds, pulling cores and ejecting castings, very much in the manner of die casting machinery.

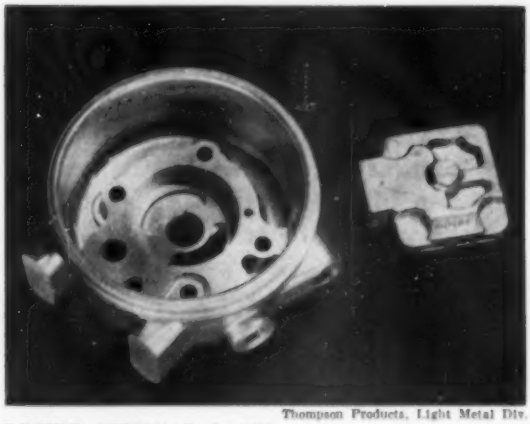
Production rates can also be increased by a simple expedient of using multiple molds or multiple cavities, since the cost of molds is considerably lower than for comparable die casting die cavities. The use of multiple molds running simultaneously has the added attraction of keeping production going, even when it is necessary to remove one mold from production for repair or maintenance. Duplicate molds thus provide excellent stand-by insurance for maintaining production schedules.

Tooling a permanent mold casting job for high production calls for relatively little additional cost, requiring only installation of air cylinders, limit switches and timers. Even the pouring operation can now be automatically controlled. Although one foundry has a completely automatic continuous pouring operation with molds mounted on a large turntable*, simpler units are also in use in which commercially available automatic ladling furnaces are applied.

While the excellent physical properties of permanent mold castings depend upon an unhurried solidification period, and therefore, this part of the operation cannot be speeded, it is possible to pour multiple molds, to get maximum output from each operator while castings cool.

**FLEXIBILITY OF OPERATION.** When new product models are being readied for mass-production, and where cost factors favor modification of the die or mold, the characteristic flexibility of operation is of great importance. Down time during modification can be and frequently is lengthy. When duplicate molds are employed, as mentioned above, tooling changes can be accomplished one mold at a time. Castings continue to flow,

* *Continuous Melting and Automatic Pouring*, PMM, Sept. 1955, p 109.



Thompson Products, Light Metal Div.

POWER STEERING PARTS

# Used For Long Runs

assuring against down-time of entire production or assembly lines that require these castings.

Another advantage arising from this flexibility of operation is the variety of casting orders that can be run during a working shift. Any given number of separate molds can be poured, limited only by the physical setup of the permanent mold foundry. The long setup time required for die casting, and the relative inflexibility of the equipment used, make it most economical to run

*continued on page 77*

Eastern Casting Corp.

REFRIGERATION PISTON & ROD

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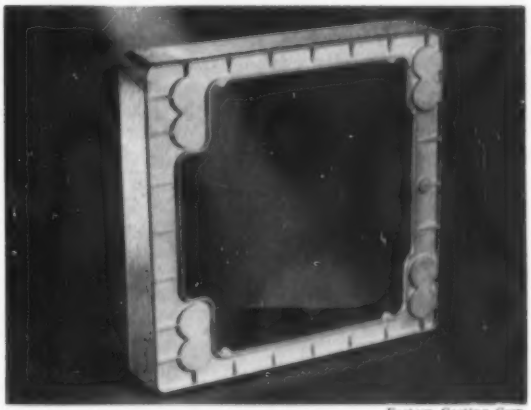
WASHING MACHINE AGITATORS



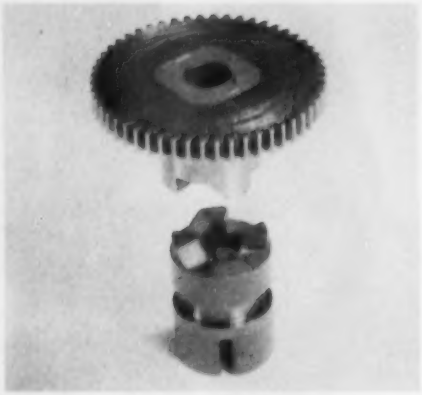
Eastern Casting Corp.

BUSINESS MACHINE BASE

Monarch Aluminum Mfg. Co.

COOKING WARE

## POWDER METALLURGY



**HIGH-STRENGTH DRIVE UNIT MADE FROM POWDERED IRON**

The drive clutch for the Nutone Mixer is made from iron powder. The two parts of it are shown above. The one-half of the clutch that is fastened to the gear must serve as both a drive unit and as a self-lubricating bushing. Since the part must transmit the full torque that is developed, there is a considerable shear stress on the teeth. The part is made from iron powder and hardened. Because it is used as a bushing, it cannot be impregnated with copper or brass and full strength must be developed by the sintering and hardening.

In order to fasten the one clutch part into the gear, the clutch is molded with a square shank which fits tightly into a broached hole in the gear. After pressing in, a simple staking operation is sufficient to hold the two parts together. On this part the bore of the clutch-half must act as the upper bushing for the motor shaft. Further, the OD of this piece must fit a porous bronze bushing that has been pressed into the body half of the die cast gear case. In addition, the final driven gear in the speed reduction train is fastened rigidly to the clutch member.

All of these particulars combine to require very exacting concentricity and dimensional tolerances on the powdered metal part. In practice, it has been found that the fabricator is able to control sizes, so closely that no machining needs to be done on the part prior to assembly.

The other half of the clutch fits into the lower and locking portion of the bowl support and drive assembly (Figure 5). This die casting has a porous bronze bushing pressed into a machined hole and the clutch member rotates in this bushing.

*Continued on page 85*

**When a number of special features are designed into a new product, the chances are that die castings will help to include these integrally, as is illustrated by . . .**

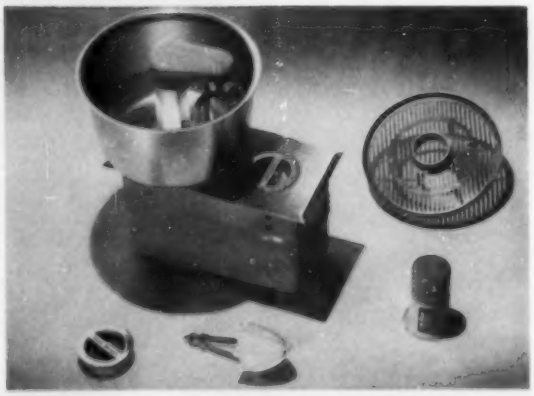
# The Built-In

THE trend today in home building is toward built-in appliances. These appreciate the value of a house, and also solve a problem, for the housewife, of handling and storage. This latter point is of greatest importance when dealing with the smaller appliances. An example is the kitchen food mixer: normally, it is tucked away on a shelf or in a cupboard where it is forgotten and seldom used; or it stands ready on top of the counter but nearly always in the way when not in use.

To provide a unit that presents the utmost convenience and the least storage problem, NuTone, Inc. has designed a food mixer with a motor and drive units built into the counter so that only a thin metal plate extends above the normally flat surface. This unit, Figure 1, is always ready for use and presents no greater storage problem than is encountered with an ordinary kitchen mixing bowl and egg beater.

Not only does this new mixer present a new concept in built-in appliances, but it also brings out that, when a part design is rigidly fixed by function, not infrequently *die casting is the only possible method of making the part.* This is the case with ten parts on this mixer—they had to be die castings.

## DIE CASTINGS



**1. BOTH ZINC AND ALUMINUM** die castings figure prominently in this counter-top food mixer, designed for the trend toward built-in kitchen appliances. Entire power unit is hidden beneath the counter surface.

COVER STORY

# Mixer With Built-In Features

What then are the particular properties that dictated the use of die castings?

1. Rigidity and strength in a combination that could only be achieved by a casting or forging or by machining from wrought stock. Economically, the two latter methods are too expensive to consider.
2. Close adherence to dimensions without major machining. This eliminated sand casting.
3. A die castable metal that can be used in contact with food. This dictated aluminum for some parts.
4. An as-cast surface finish that can be painted, plated or polished without excessive surface preparation. Here die castings with a "hardware finish" filled the bill.

The motor casting (Figures 2 and 4) is in zinc and must function, not only as a supporting and containing member, but must also align the rotor for field coil clearance and so that the pinion on the shaft meshes with the gear in the speed reduction train. A further requirement is that this casting be dimensionally stable over a period of years at normal operating temperatures.

Since considerable torque is required to operate the mixer, a 16,000 rpm motor has to develop a full 1/5 hp. In a relatively small package, this power output requires the dissipation of considerable heat. Fan cooling is employed and, because of the rigidity of the die casting, almost the entire bottom of the casting can be open as an air intake. Thus, large volumes of air can be drawn through the motor. The casting is made with sufficient accuracy so that little machining is needed. Six operations complete the part. They are:

1. Facing.
2. Bore for field diameter.
3. Machine bearing seat.
4. Machine diameter for bearing retainer.
5. Ream brush holder holes.
6. Tap four holes.

The gear housing (Figure 4) again illustrates the accuracy with which zinc die castings can be made. The motor shaft passes through the cover plate and, inside the box, the pinion meshes with a gear. The shaft continues through the center of one of the

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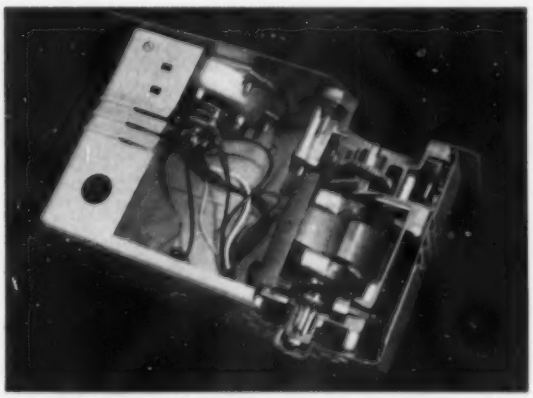

**2. DIMENSIONAL STABILITY** over a prolonged period is one vital requirement of the die cast zinc motor housing which functions to support, align and protect the 16,000 RPM motor which develops 1/5 hp.

**3. TO HOLD THE GEARING** for driving the beater blade and the bowl, this head assembly consists of a pair of aluminum die castings, shown here in a cutaway view. Finish is by painting and baking.

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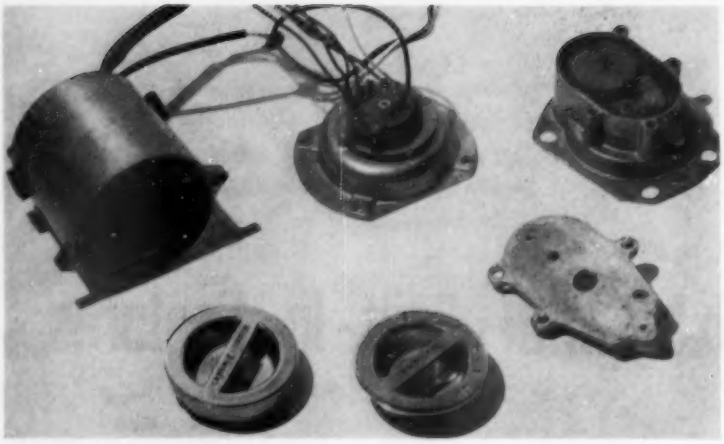
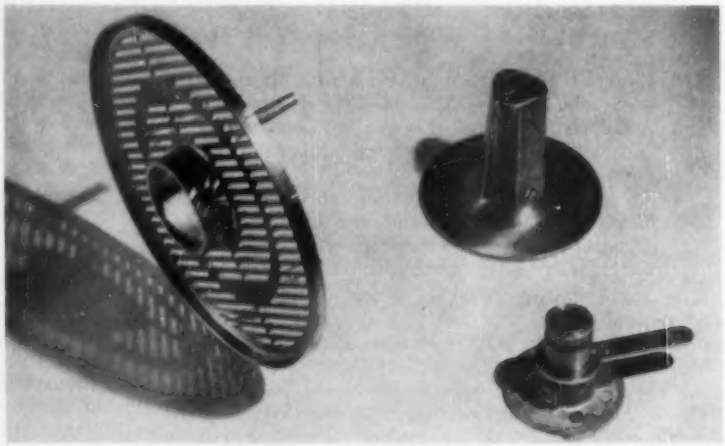


**4. POWER PACKAGE** of the NuTone mixer contains several zinc die castings: motor housing, top left; gear housing and cover, right; and switch well, top center. Two additional castings are the switch knob and cover plate, shown in the foreground.



**5. CONTACT WITH FOOD** has caused these castings to be made of aluminum. They are: bowl support castings, right, and juice strainer, left. Lower bowl support casting, bottom right, is cast substantially complete, needing only a light facing. The actual bowl support casting requires only scratch brushing and the reaming of one hole.



main drive gears with its associated clutch part and extends into the counter top plate sufficiently far to engage a blender unit when desired. In other words, the top bearing for the motor is this last driven gear and clutch member. Reference to this is made on page 62.

The gear housing consists of two castings, one of which serves as a mounting member for the motor and the other as the cast recess into which the different attachments, such as the mixer bowl support, the blender and the knife sharpener, are set. In both of these castings, it is important that the cored holes be positioned accurately so that, when bushings are pressed in, the proper center distances for the reduction gears is secured.

The matching faces of the two castings must be flat and exactly at right angles to the center-line of the cored holes, so that the motor rotor will line up properly when the housing for the motor is fastened to one of the gear box castings. Since the desired accuracy cannot be secured as-cast, it is necessary to machine these parts in pairs, drill holes for center distance and machine top and bottom faces. These parts must then be kept in pairs as they are no longer interchangeable.

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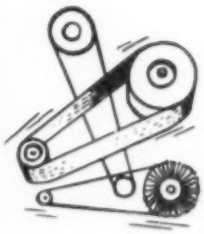
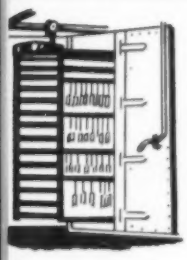
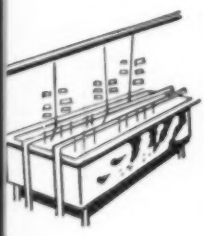
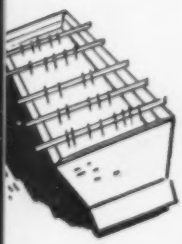
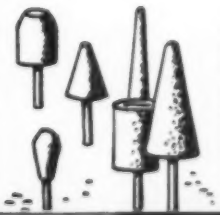



# Finishing Section

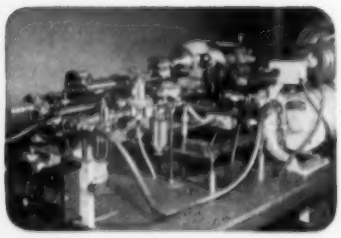




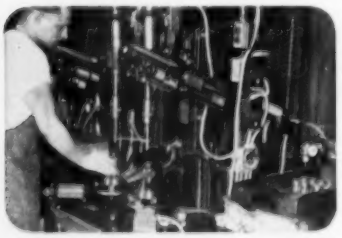


**Finishing includes all secondary operations performed on precision metal molded parts — up to and including final surface treatment. This section presents new information about the specialized methods, equipment and materials needed for finish-machining, assembly, surface preparation and final finishing of all precision metal molded parts.**

# Are you afraid of AUTOMATION . . .



For example, this lathe, equipped with two Bellows Fluid Power Units—performs four operations on the steel shells of oil seals. The fluid power method stepped up production 450%.



Here's a case where Fluid Power control enables one operator to turn out the work of four. He services two units like the one shown. The operation is a critical reaming job on the six chambers of a revolver cylinder.

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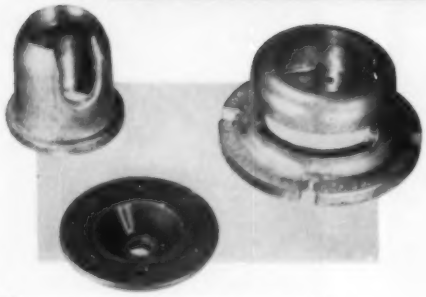

## Here's a new slant on . . .

# Work Positioning

*Three sturdy die castings make up the body of the most popular model of this work positioner.*

HOW to hold a unit during assembly can be a vexing production problem. To mount several components at various angles on different surfaces calls for a great deal of wasteful handling . . . lifting, turning, balancing . . . and often requires special fixtures.

This is especially true of assembly line operations involving die cast housings, frames or chassis, since these often run to complex shapes. (One of the prime reasons for using a die cast mounting member is the ability to include all of the mounting configurations integrally.) For example, among the products commonly using die cast mounting members are business machines, household appliances, portable tools, vending and dispensing machines and engine-powered equipment; each of these is likely to include some awkward assembly sequences.

Where special, stationary fixtures are needed, the operation becomes not only unhandy but also expensive. A typical piece of office equipment such as an adding or calculating machine may have dozens of separate assembly operations, each of which is performed at a different station on the line. Many of these stations will need individual holding fixtures, custom designed and built. When the work piece is moved from one fixture to another, considerable time and effort are needed to place, clamp and unclamp.

A new type of device being widely accepted as a production line tool is a standard work positioner that is universally adjustable by means of a simple hand lever or hydraulic mechanism. The work piece is held in a fixture mounted atop the positioner, and can be rotated or tilted at any convenient angle with a minimum of time or manual effort.

*Continued next page*

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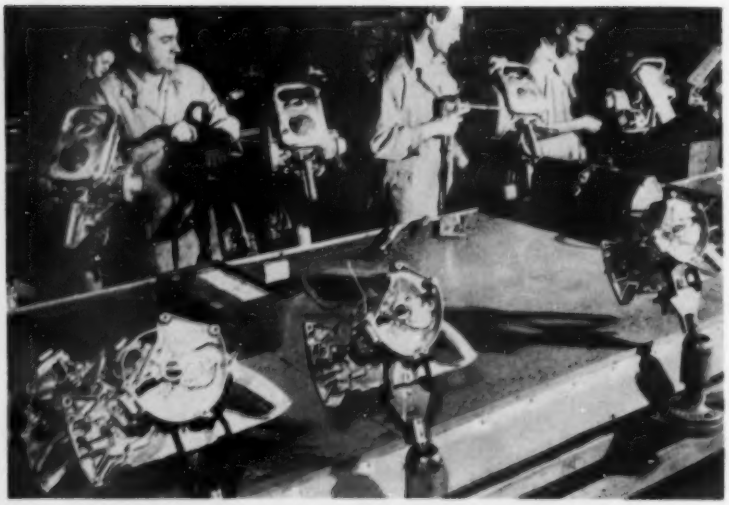


**CONVEYORIZED WORK POSITIONERS** move along from station-to-station on this efficient assembly line for die cast chain saws. The work can be rotated to any angle for ease of assembly. Only one fixture is needed for the entire sequence of operations.

**SIMPLE HAND LEVER** within easy reach of the operator allows the work holder to be adjusted quickly while the line is moving.

**IN FIXED POSITION,** this universal work positioner becomes a general-purpose fixture. Unit illustrated is built of die castings.

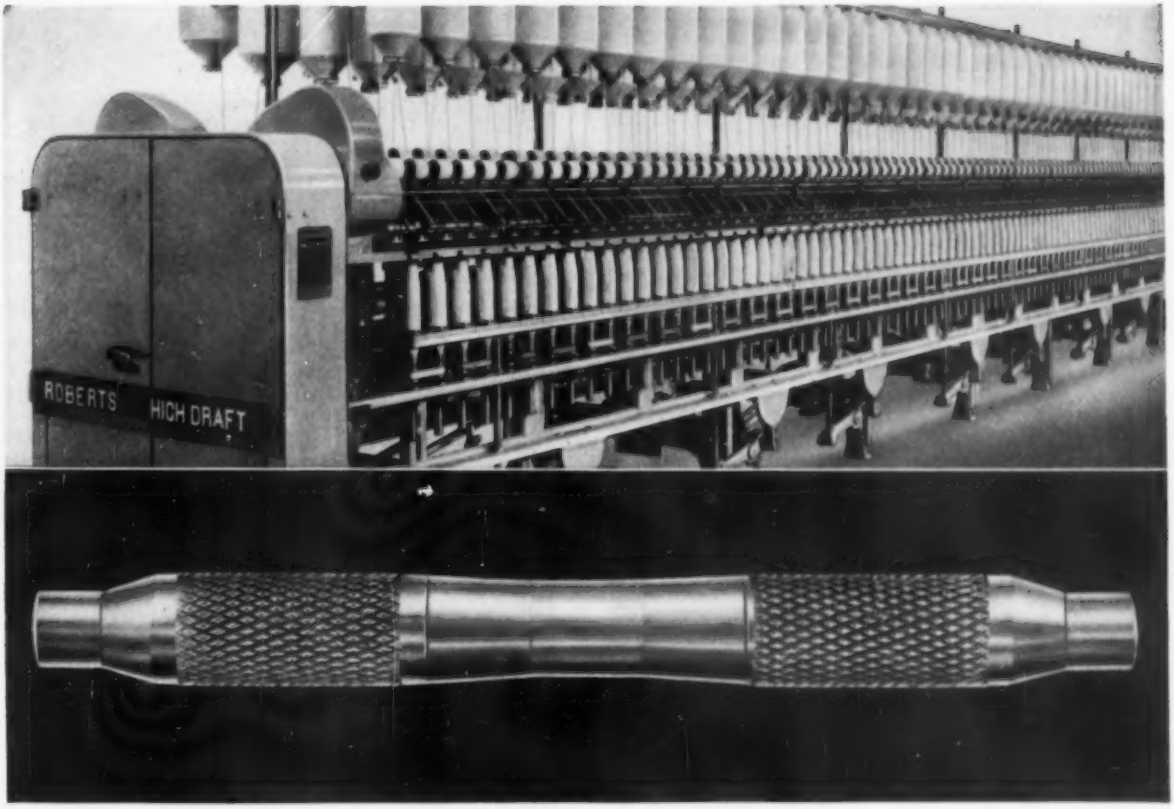
WORK POSITIONERS — continued

Several examples of the use of these work positioners, as applied to production line operations, are illustrated here. These provide a means of moving the work from position to position without special fixtures or extra handling.

The manufacturer of these units, identified as PowRarm Work Positioners, is the Wilton Tool Mfg. Co., Inc. The most popular model, capable of carrying work weighing up to 24 pounds, is built of aluminum die castings. Quantities in which this model is sold have justified the investment in die casting tools. Other models can take work loads up to 1000 pounds.

The manner in which these work positioners are used varies considerably. They are solidly mounted to the bench in small assembly jobs where one operator is required to work on several surfaces, but may be mounted on moving conveyors, or similar mobile arrangements where the work progresses from station to station. Here, the operator needs only loosen the locking mecha-

*Continued on page 75*

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## PERMANENT MOLD CASTINGS

**1. STREET LIGHTING** fixtures start with this semi-permanent mold with the green sand core in place. The mold is closed, molten aluminum (alloy 43S) is poured, and the cast part allowed to cool.

**2. AFTER COOLING,** the casting is taken from the mold and the sand core is removed. Clean removal without damage to the surface of the casting requires that this be a hand operation.

**4. A GRINDING WHEEL** completes the trimming operation. Because of the irregular shape of the housing and because parts of widely different shape and size are in production at the same time, this must be a non-automatic operation.

**5. PARTING LINE REMOVAL** on the inside cannot be done readily on large wheels. Small, air-operated grinders and chippers are used for this operation. The specially designed table holds the housing, and by turning the part over, the table top is used for any slight flattening.

**3. GATE AND FLASH** are now removed using a metal cutting band saw. With a skilled operator only vestigal fins remain after this operation. The metal removed goes back to be remelted.

**6. EXCEPT FOR SMALL HOLES,** the permanent mold casting operation permits reproduction of all details. Here, on a multiple spindle set-up, holes are drilled at points center spotted in the casting, some holes are tapped and four bosses are milled flat to position the reflector.

*Ability to withstand severe outdoor exposure and all manner of abuse are among the important features of this completely assembled street lighting fixture, built with permanent mold castings.*

# Cleanup And Finishing Of Lighting Fixtures

IN the manufacture of lighting fixtures for outdoor applications the materials of construction and the methods of fabrication must be specifically tailored to withstand all sorts of climatic conditions and man-made abuse resulting from irregular service and maintenance.

Corrosion due to air-borne materials such as sulfur compounds, salt, and other industrial fumes; rain, snow and winds up to near hurricane velocities must all be withstood by these fixtures.

For these reasons as well as for the most economical manufacture, Westinghouse Electric Corp. has chosen permanent mold castings of 43S aluminum as the method and material of manufacture. These castings have been found to give the best possible combination of strength, resistance to corrosion and erosion, and low manufacturing costs. The surface smoothness and as-cast accuracy are fully adequate for the required service; expensive jigs and fixtures have been eliminated; and no surface treatment of any sort is required for protective reasons.

Here is a pictorial presentation from molten metal to finished fixture for one model of street lighting fixture.

*(Advertisement)*

# SPECIAL REPORTS ON FINISHING NON-FERROUS METALS

## NUMBER III—Lustrous, Corrosion-Resistant Finishing with Chemical Polishing Iridite

**WHAT IS IRIDITE?**

**Briefly, Iridite is the tradename for a specialized line of chromate conversion finishes. They are generally applied by dip, some by brush or spray, at or near room temperature, with automatic equipment or manual finishing facilities. During application, a chemical reaction occurs that produces a thin (.00002" max.) gel-like, complex chromate film of a non-porous nature on the surface of the metal. This film is an integral part of the metal itself, thus cannot flake, chip or peel. No special equipment, exhaust systems or specially trained personnel are required.**

Chromate conversion coatings are widely accepted throughout industry as an economical means of providing corrosion protection, a good base for paint and decorative finishes for non-ferrous metals. Certain of these coatings also possess chemical polishing abilities that have luster-producing, as well as corrosion-inhibiting, effects on zinc and cadmium plate, zinc die castings and copper alloys. However, continued developments in this field have been so rapid that many manufacturers may not be completely aware of the breadth of application of this type of finish. Hence, this discussion of the many ways in which this chemical polishing characteristic can be used in final finishing or pre-plating treatments to produce a lustrous appearance with distinct display and sales appeal and appreciable savings in cost. Report I on decorative, corrosion-resistant finishes and Report II on paint base corrosion-resistant finishes are available on request.

The degree of luster possible on a surface is a function of the degree to which the surface can be smoothed. Leveling to provide a smooth surface can be achieved by mechanical or chemical means, or a combination of these, depending upon the luster desired and the original condition of the metal. Chemical polishing effectively imparts luster otherwise difficult and costly to obtain. For this reason, it is often used to supplement or entirely replace mechanical polishing, depending upon the application and the original condition of the metal. Chemical polishing has the additional advantage of providing overall treatment of the submerged part. It reaches into even the deepest corners and recesses that are otherwise inaccessible. Certain of the Iridites are specifically designed to perform this chemical polishing operation. Also, they provide corrosion protection as do all Iridites, thus may be used as a final finish or a pre-plating polish.

If Iridite is to be used as a final finish, in contrast to pre-plating treatment, the chromate conversion coating generated is allowed to remain, providing good corrosion resistance. Color inherent in these Iridite films ranges from a yellow cast to yellow iridescent. These coatings may be used without further treatment where this color is acceptable and good corrosion resistance is desired. Further, these basic coatings can be tinted by dyeing. Among the dye tints available are shades of red, yellow, blue and green. If desirable, the basic coatings can also be modified by a bleach dip leaving a clear bright or blue iridescent finish. In all cases bleaching reduces corrosion resistance.

As examples of this type of final finishing, Iridites #4-73 and #4-75 (Cast-Zinc-Brite) make possible for the first time, lustrous chemical polishing of the as-cast surface of zinc die castings. Thus, in many cases, sizeable savings in finishing cost are realized by elimination of plating costs. This economical method can be used on tools, appliance parts, toy pistols, locks and many other small castings. Another example is the treatment of copper and brass parts, such as welding tips, to eliminate buffing and provide additional corrosion resistance. In many cases, handling costs are reduced appreciably by replacing piece-part handling with bulk processing. Still another example of the use of this chemical polishing and protective quality of Iridite is a simple system of zinc plate, Iridite and clear lacquer instead of more costly electroplated finishes. Typical of this type of lustrous finish are builders hardware and wire goods.

As a pre-plating treatment, in contrast to final finishes, Iridite can be used to chemically polish zinc die castings or copper prior to plating. In such cases, Iridite should be applied as an in-process step, so that the protective film is removed before the plating cycle. The savings in handling, material and labor costs are obvious. This process has made it practical to plate chrome directly over copper on steel, conserving nickel, yet producing a lustrous chrome finish. Used after stripping faulty plate in reprocessing zinc die castings, Iridite restores luster to the casting, thus making possible replating without blistering.

Other Iridite finishes are available to produce maximum corrosion resistance, a wide variety of decorative finishes and excellent bases for paint on all commercial forms of the more commonly used non-ferrous metals. As a final finish, appearance ranges from clear bright to olive drab and brown and many films can be bleached or dyed. As a paint base Iridite provides excellent initial and retentive paint adhesion and a self-healing property which protects bare metal if exposed by scratching. Iridites have low electrical resistance. Some can be soldered and welded. The Iridite film itself does not affect the dimensional stability of close tolerance parts.

Iridites are widely approved under both Armed Services and industrial specifications because of their top performance, low cost and savings of materials and equipment.

You can see then, that with the many factors to be considered, selection of the Iridite best suited to your product demands the services of a specialist. That's why Allied maintains a staff of competent Field Engineers—to help you select the Iridite to make your installation most efficient in improving the quality of your product. You'll find your Allied Field Engineer listed under "Plating Supplies" in your classified telephone book. Or, write direct and tell us your problem. Complete literature and data, as well as sample part processing, is available. Allied Research Products, Inc., 4004-06 East Monument Street, Baltimore 5, Maryland.

*For more information circle No. 69 on the Reader Service Card*

# How To Clean Die Castings Before Finishing

**By T. MURRAY**
Metal Working Department,
E. F. Houghton & Co.

THE selection of an effective cleaning method for die cast zinc and aluminum parts depends on several factors: the alloy composition, the nature of the die casting lubricant used in their manufacture, the subsequent finishing operation prior to cleaning such as buffing or machining, the end results desired, and the availability of equipment required to do the cleaning job satisfactorily.

Once started, the operation must proceed at a fast pace. It must be continuous and the parts should not be permitted to dry between stages or spotty, unsatisfactory results will be obtained.

The problem is to keep the pickling and cleaning cycles to a minimum — just enough to assure complete removal of soil and neutralization of alkaline residues.

Cleaning of die castings is accomplished by one or more of these methods:

1. **Mechanical Cleaning** — Employed where uniform surface is desired or large amounts of metal are to be removed. This method may vary from grinding to sand blasting or abrasive tumbling and to polishing and buffing.

2. **Solvent Cleaning** — This is effected by dipping in a suitable solvent or by vapor degreasing techniques. This method lends itself particularly well to the removal of oils or waxes.

3. **Alkaline Cleaning** — This is perhaps the most widely used method for cleaning die castings because of the low initial investment required for equipment. The industry generally is more familiar with the use of alkaline cleaners than with other methods.

Care must be exercised in selection of the proprietary compound used as many alkaline solutions are capable of removing oil and grease from aluminum and zinc but still prove to be unsatisfactory. This is because some of such cleaners tend to produce an etch or to discolor the casting surface.

An alkaline cleaner best suited for die casting work must be free-rinsing, rapid in rate of penetration, inhibited to prevent etching and possessing the ability to soften hard water conditions so as to prevent a spotty appearance on the surface when drying.

Alkaline cleaners are usually added to hot water at temperatures between 140 and 180 F in quantities of about 4 to 6 ounces per gallon of water. A period of 5 minutes in the bath should be sufficient to remove ordinary soils.

When aluminum die castings are to be plated, the alkaline method of cleaning is usually employed, either alone or in conjunction with the mechanical or solvent processes.

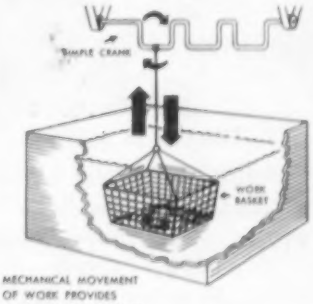
After the cleaning bath the procedure is as follows:

1. Hot water rinse.
2. Acid dip — approximately 25% $HNO_3$ solution (by volume) at room temperature.
3. Cold water rinse to remove all trace of acid.

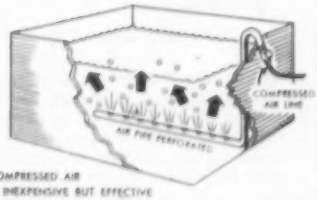
*Continued next page*

## 3 WAYS TO IMPROVE STILL TANK EFFICIENCY

Several simple, inexpensive methods of providing agitation or circulation of the solution are available to improve the efficiency of still tank plating. Any action that keeps the solution in motion helps carry the emulsified soil away from the work being cleaned.




MECHANICAL MOVEMENT OF WORK PROVIDES AGITATION OF SOLUTION

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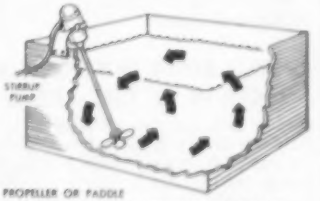


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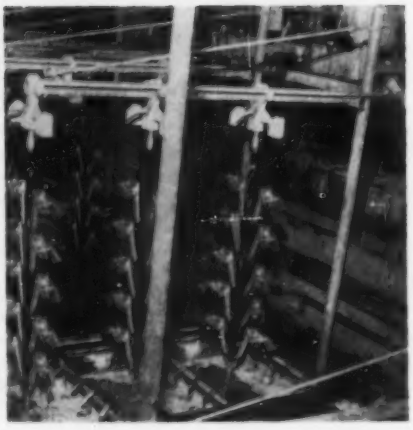
**PROPER DRYING** is an important adjunct of the cleaning cycle. Here, in the finishing department of a toy manufacturer, is shown the centrifuge where parts are spun dry after final rinsing operation, insuring a spot-free, bright finish.



**COPPER PLATING** prior to nickel plating is shown here. The preliminary cleaning of the die cast pieces is of critical importance in the development of a good and durable electroplate. The system shown here is part of an automatic plating line for finishing die cast toy pistols.

CLEANING DIE CASTINGS—Continued

4. Zincate dip, ½ to 1 minute (or phosphoric acid anodizing).
5. Cold water rinse—overflowing tank.
6. Cold water rinse—overflowing tank.
7. Plating operation.

When the cast alloys contain a high percentage of silicon or magnesium, it is customary to strip the zinc coating with nitric acid followed by a second treatment in the zincate bath.

Zinc base die castings are cleaned either in an alkaline soak tank or by electrolytic methods. The cleaning is followed by:

1. Cold overflow rinse.
2. Weak acid pickle 1% solution.
3. Cold overflow rinse.
4. Copper strike.

The alkaline cleaning method has been found to appeal because of the low cost of the equipment required to set up a procedure. By simple trial and error the proper proportions can be worked out according to the severity of the contamination. Speed of the entire process is important as is cleanliness of the rinse tanks and purity of the cleaning compounds.

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## POSITIONER

*continued from page 68*

nism by means of a hand lever, turn the work to the proper position, and retighten the lever.

Principle on which the positioner operates is that of a ball and socket. Moving the lever into lock position forces a brass pressure plate upward against the ball, forcing it tightly into the socket and preventing motion. A shaft extending upward from the ball supports the work piece in fixed position.

## POWDER METAL TOOLING SUBJECT OF ASTE BOOK

Future publication of three more engineering reference books has been announced by the American Society of Tool Engineers. "Machining With Carbides and Oxides" will combine the latest data on oxide (ceramic) tools with available information on carbide tooling and operations. "Jig and Fixture Design" will offer reference material for the tool engineer and "Planning and Tooling For Powder Metal Parts" will cover the practical data needed in design and production of powdered metal parts.

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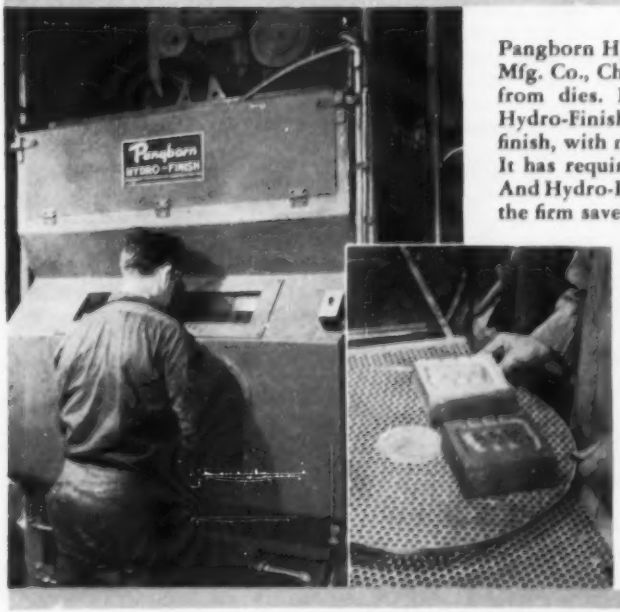
# Pangborn HYDRO-FINISH wet blasting saves $22,500 a year for Imperial Brass!




Pangborn Hydro-Finish wet blasting is used at Imperial Brass Mfg. Co., Chicago, to remove heat scale and carbon deposits from dies. Imperial Brass is highly gratified with results. Hydro-Finish does a perfect cleaning job and gives a smooth finish, with no breakdown of sharp edges or loss of tolerances. It has required no maintenance in its 1½ years of operation. And Hydro-Finish has cut time and labor costs so drastically that the firm saves $22,500 a year on this step alone!

If *you* clean dies and molds, you should investigate Pangborn Hydro-Finish . . . now offering even lower investment and more efficient operation by using air jet sluriators instead of a pump. Write today for Bulletin 1402 to PANGBORN CORPORATION, 3500 Pangborn Boulevard, Hagerstown, Maryland. *Manufacturers of Blast Cleaning and Dust Control Equipment.*

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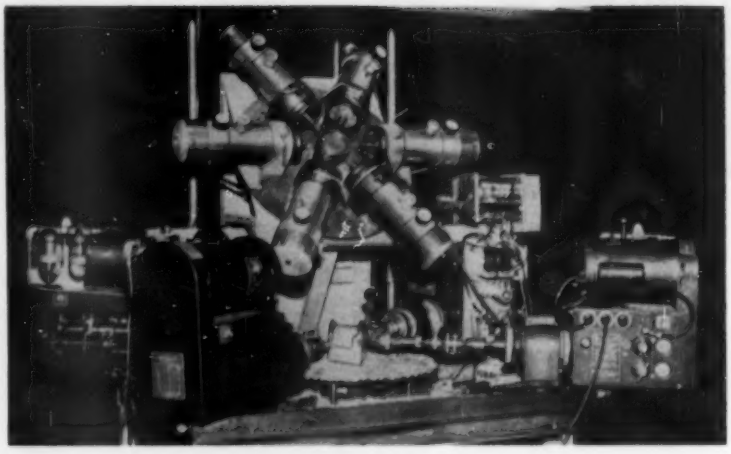

# Special Setups With Stock Units

OF particular importance in the industrial manufacturing field today is the availability of standard machine units which can be readily and economically purchased and combined with fixtures to provide special machinery set-ups for a multitude of production work at higher rates and at a lower per-piece cost.

One manufacturer which has taken advantage of this opportunity is the Presto Line Corp., Los Angeles. They use three types of easily obtained automatic drilling units, all from the same source. These are combined into the unique, special machine set-up as shown above. On it, zinc die castings are recessed, tapped and drilled in one continuous operation handled by one man. 260 to 300 pieces flow through this set-up with *no scrap losses* and with tolerances held well within the specifications.

## Set-up Details

The set-up consists of two Dumore Series 24 automatic drill units mounted on a work table with simple nose brackets, one on the right front corner and the other located diagonally opposite. These recess both ends of the castings with Tru-Arc tool attachments at the same time.

On the other two corners, also diagonally opposed, are two Dumore Series 28 "Drill-N-Tap" units which tap both ends of the castings simultaneously, after they are indexed automatically from recessing position. A cam operated by a small electric motor controls the operation of both the No. 24 and the No. 28 units.

The operator then places the workpiece on the fixture above, consisting of six Dumore Series 20 automatic drill heads which drill six 3/32" holes in each piece simultaneously.

During the flow of work through this special machine, it is highly significant to note that the Presto Line Corp. gets a bonus operation without extra manpower. While the table set-up is recessing and tapping pieces, the upper set-up of six drill heads, drills the six holes required. One operator easily handles the workpiece twice but in what is practically one continuous operation. To all intents and purposes the drilling is a relatively free operation.

By using these three types of standard components, this manufacturer gained quick, precision automation at low initial machine cost. Faster delivery, lower per-piece cost, less manpower and greater machine interchangeability resulted, as well.

## PERMANENT MOLD

*continued from page 61*

a single job without changing dies for as long a time as possible. It is not possible to use one die casting machine to produce a number of castings from different dies at the same time, as is commonly done in permanent mold casting.

The direction in which the permanent mold casting industry has been moving indicates further mechanization and consequent increase in output per man hour. Such automatic operations as the continuous melting and automatic pouring mentioned above, whereby a cold ingot is transformed into a casting in 15 minutes, have reduced the number of manual operations drastically. Direct ratio of manpower per casting can, in such a highly mechanized system, be about equal to that in the die casting industry which is generally regarded as representing the ultimate in output per man hour.

**ADAPTABILITY TO PRODUCT DESIGN.** Part of the reason for a steady increase in use of permanent mold castings lies in the manner in which this process can be adapted to product design. The nature of the mold construction is such that it can be "built around" the designer's concept.

Designers in a number of industries are finding permanent mold castings both economical and serviceable. These include not only the well-known applications in the cookware and automotive piston fields, but also in such other big volume industries as business machines, photo equipment, refrigeration products, trucks and transportation, and hardware. Several examples of these mass-produced permanent mold castings are included here.

**IMPROVED METAL STRUCTURE.** Where strength to weight ratio is a dominant factor in the selection of a casting method, aluminum permanent mold has enjoyed an advantage. Slower rate of chilling of the casting produces superior metal structure and greater casting strength. Uniformity of metal with its improved machineability permits higher tool speeds and faster machining operations. Not having a surface brittleness induced by rapid cooling, tool life is prolonged.

For certain types of castings, such as where machining must be accomplished, and where blow holes or porosity may cause rejection, permanent mold castings are preferred. The denseness and soundness of the metal due to its more uniform cooling permit parts that require either pressure or vacuum tightness to be cast by this method with very small loss due to rejection.

**FINISHABILITY.** The as-cast surface is readily adaptable to variety of finishing methods. Preparatory finishing is simplified and sometimes several operations eliminated. A number of foundries now offer finishes that provide a long lasting high lustre and impart a durable mar-resistant surface. One foundry now offers a colored porcelain enamel finish** that adds sales value to a product. On other applications the porcelain surface imparts salt, acid and detergent corrosion resistance.

These production advantages add up in the total cost picture when arriving at the factual end-cost of the finished product.

Continuing pioneering as illustrated here in all methods of precision castings, as well as wider recognition among product manufacturers of the specific advantage each method offers, indicates a future of substantial gain in the use of precision cast-

** *Vitreous Enamel for Aluminum Permanent Mold Castings*, PMM, April 1955, p 60.

*Continued on page 79*


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REVERSING EXTRUSION FINISHER

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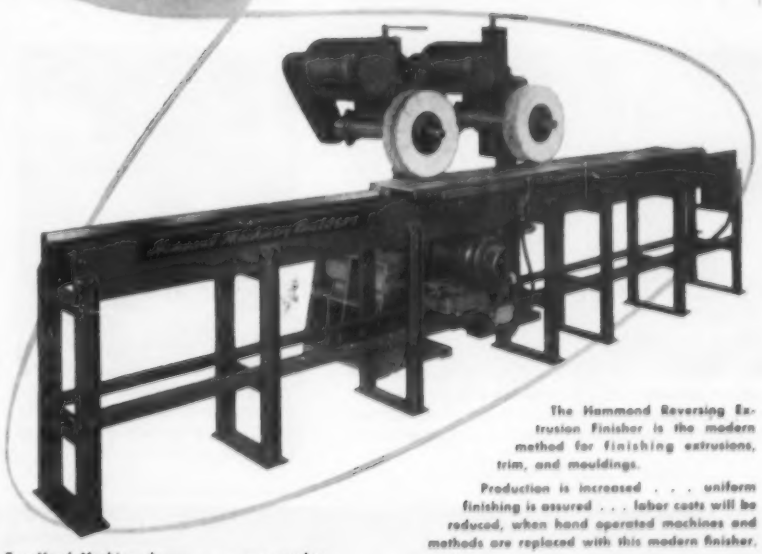

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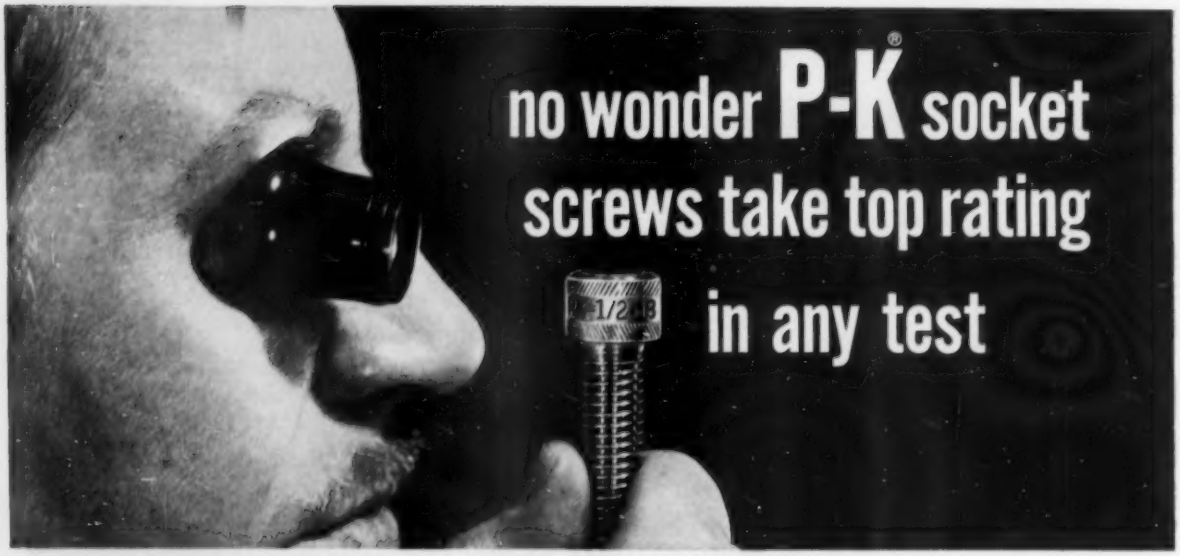

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## 1956 ACHESON MEDAL GOES TO DR. R. M. BURNS

Dr. R. M. Burns, senior scientific advisor to Stanford University Research Institute, Palo Alto, California has been awarded the Acheson Medal of The Electrochemical Society for 1956. The medal and a prize of $1,000 was presented to Dr. Burns by Hans Thurnauer, president of The Electrochemical Society, during its national meeting at Cleveland, Ohio.

The Acheson Medal, awarded every two years for notable contributions to the advancement of the objectives, purposes and activities of the The Electrochemical Society, was given this year in recognition of Dr. Burns' outstanding work on the corrosion of metals and his long-time participation and leadership in the affairs of the Society.

Dr. Burns' award comes in the centennial year of the birth of Dr. Edward Goodrich Acheson.

## LETTERS

*continued from page 35*

## PERMANENT MOLD CASTING?

We have several items in our line of cast aluminum reproductions that we feel are capable of being cast in permanent molds.

Please advise us of the names of any companies that will make the permanent mold dies and also the machines for putting the dies in continuous production. — W.E.S. (President)

*Names of experienced producers of permanent mold dies, and the equipment for permanent mold casting, have been forwarded. In many plants, permanent mold dies are complete in themselves, including the hydraulic or pneumatic actuation necessary to operate them. — Ed.*

## HOUSINGS FOR CASTERS

If it is possible would you be so kind as to supply us with a list of Manufacturers of Aluminum Housings for Casters.

I have corresponded with a number of manufacturers of Casters and Wheels but none to whom I have written manufacture Aluminum Housings for Casters and Wheels.

I would appreciate a list of manufacturers who sell directly to manufacturers of Floor Trucks and Hand Trucks rather than one who sells only thru local distributors. — J.E.S. (Sales Manager)

*We do not have a list of such manufacturers available. In fact we do not know whether any company manufacturers a line of housings for casters, apart from complete assemblies. However if any of PMM's readers produce such aluminum housings, we will gladly put them in touch with this West Coast customer. — Ed.*

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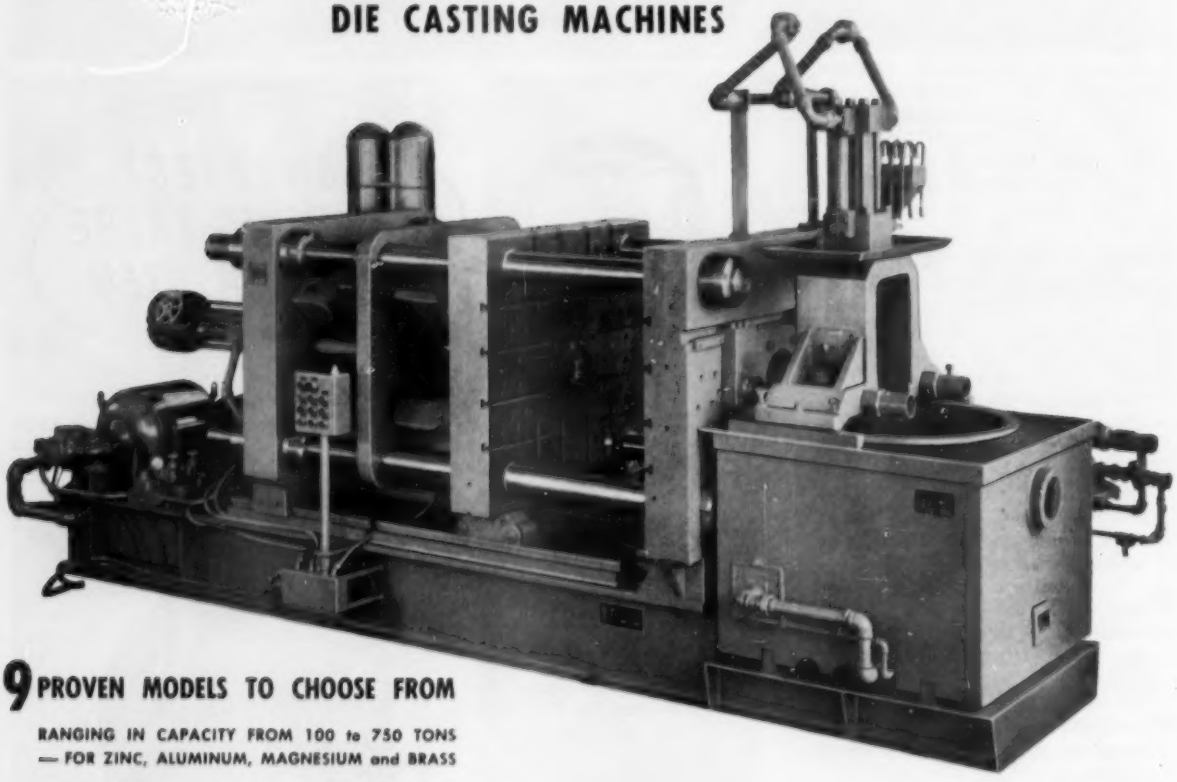

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# USEFUL LITERATURE, CATALOGS, MANUALS

*any of these technical publications may be obtained by circling the appropriate numbers on the Reader Service Cards, Pages 16-17*

## PMM PROCESSES

**Iron Powder Finishes:** 154

**Chromalloy Corp.**, 4 pages, bulletin No. 7. This folder describes the advantages of the Chromalloy process in finishing powder metallurgy parts. Photomicrographs and a test specimen table are included.

**Refractory Investment Casting:** 155

**British Industries Corp.**, 4-page illustrated fact sheet. The Shaw "Refractocast" Process for investment casting is explained. Numerous photographs show some of the parts produced by the process. Step-by-step photos present the complete process from pattern to casting.

**Malleable Iron Shell Mold Castings:** 156

**Albion Malleable Iron Co.**, 24 pages, 2-color technical manual. Characteristics, specifications, and properties of the company's pearlitic malleable iron for shell mold and sand casting are presented. Diagrams and photomicrographs illustrate hardness and strength.

## MATERIALS AND EQUIPMENT

**Powder Metal Presses:** 157

**F. J. Stokes Corp.**, 3-color, 24-page catalog No. 815. The company's complete line of powder metal presses are described. The presses comprise 37 different models, ranging in capacity from 1½ tons to 300 tons, and including both single-punch and rotary types.

**Themocouple Insulators:** 158

**Claude S. Gordon Co.**, 4 pages, 2-color Bulletin No. 300-56. Dimensions, sizes, and types available of the complete line of Serv-Rite thermocouple insulators are listed. The principal properties of the different materials are included.

**Designing For Magnesium:** 159

**Brooks & Perkins, Inc.**, 19 pages, 3-color magazine. This latest issue of "The Magazine of Magnesium," features a how-to-do-it article on designing of magnesium for minimum weight. Also included are articles on use of magnesium in fractional horsepower induction motors.

**Granite Surface Plates:** 160

**Collins Microflat Co.**, 78-page technical manual. This manual fully describes the manufacture of black granite surface plates and precision inspection accessories. An entire section is devoted to geological sources and quarry operations.

**Guide Pin Bushings:** 161

**WW Alloys, Inc., Div. of Fansteel Metallurgical Corp.**, 2 colors, Bulletin 15.404. A new line of centrifugally-cast guide pin bushings is revealed. Catalog numbers, dimensions, and specifications are listed.

**Forging, Casting Facilities:** 162

**Allegheny Ludlum Steel Corp., Forging & Casting Div.**, 30 pages, 2-color catalog. This catalog gives complete data on composite die sections, cast-to-shape tool steels, and smooth hammered forgings made by the division. A new steel finder gives detailed information on the various forging and casting steel grades.

**Tool Steel Handbook:** 163

**Allegheny Ludlum Steel Corp.**, 204 pages, engineering handbook. This book contains complete data on types, properties, and applications of tool steels. Chapters are devoted to selection of proper steel, tool steel products, and working tool and high speed steels. There is also a section of reference tables.

**Protective Coat For Molds:** 164

**The Montaine Corp.**, 4-page technical report. Background, uses, preparation and coating techniques, and foundry practice are presented for Flame Rock, an aluminum oxide coating especially desirable for protection of permanent molds. The coating is said to not only extend mold life but eliminate the need, in most cases, for any type of mold spray during operation.

**Air, Hydraulic Cylinders:** 165

**Modernair Corp.**, 2-color brochure. Engineering features are disclosed for the Provenair cylinder, a threaded-head type with interchangeable mounting brackets, and made of non-corrosive materials.

**Fire-Resistant Fluid:** 166

**Shell Oil Co.**, 2-color illustrated folder. Information has been released on Irus Fluid 902 an oil base, fire-resistant fluid which can be used as a direct replacement for hydraulic oils now in service.

## FINISHING

**Phosphate Protective Coats:** 167

**Turco Products, Inc.**, 5 pages, 2-color folder. This folder covers the entire Turcoat line of phosphating and metal protective coating materials. A portion of the folder is devoted to a general discussion of phosphating, including diagrammatic cross-sections and application photographs. Included is a phosphating reference chart.

**Metal Coating Control:** 168

**Minneapolis-Honeywell Regulator Co.**, 2-page, technical data sheet No. 5.5-1. This sheet describes the use of Honeywell instruments and controls to automatically maintain the desired boiling point and concentration of the solution used in the "Houghto-Black" coating process, developed by E. F. Houghton & Co.

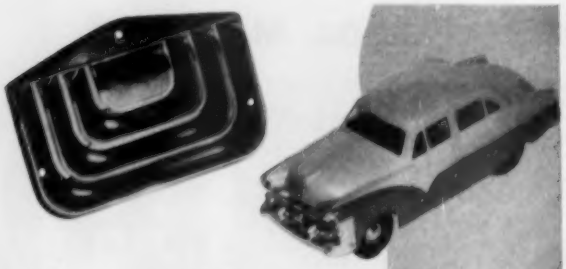
**Rotary Finisher:** 169

**Mathewson Machine Works, Inc.**, 2-color catalog sheet. Full details are given on a new rotary finisher and buffer with disc attachment for abrasive finishing of several materials. The eight-inch disc attachment is equipped with an adjustable work rest.

**Hot Spray Painting:** 170

**The DeVilbiss Co.**, 6 pages, 2-color brochure. A detailed discussion of the advantages of hot spray painting is offered. Charts and flow diagrams illustrate the method of achieving the best results with the hot spray.

*Continued on page 82*



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## USEFUL LITERATURE

*continued from page 81*

**Mist Coolant System:** 171

**Trico Fuse Mfg. Co.,** 1 page, 2-color Bulletin No. 37. Advantages, applications, and construction features are listed for a mist coolant system which eliminates heat from cutting edges of tools and work by absorption of the heat. Description of the available types is also given.

**Filter Pump Units:** 172

**Sethco Mfg. Co.,** 8 pages, 2-color Bulletin 102. A description is given of newly designed filter pumps for highly corrosive solutions. Specific filtration equipment is described for solving special problems and photographs show pumps in action. Complete price sheets are also enclosed.

**Machinery Lapping Compound:** 173

**Timesaver Products Co.,** 24 pages, 3-color technical booklet. A detailed outline is given on the money-saving methods of fitting bearings, gears, slides, pistons, etc. with a new lapping compound. Photographs and comparative descriptions show the essential qualities for precision fits on all bearing surfaces.

**Die-Cut Masks and Stencils:** 174

**Gleicher Mfg. Corp.,** 3-page, 2-color brochure. The various applications of the company's die-cut, pressure-sensitive tape masks and stencils are described. The masks can be used for buffing patterns, trademarks, or insignia on all types of castings. Samples of the masks and stencils are enclosed with the brochure.


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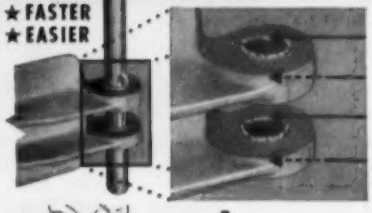

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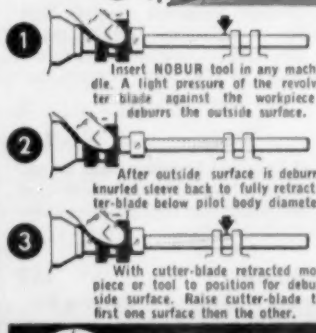

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**Heat Treating Reports:** 175

**Surface Combustion Corp.**, 8 pages, 3-color Vol. 7, No. 2 of Heat Treat Review. This latest issue features articles on a pit-type furnace for treating copper alloys and basic principles of gas carburizing. Technical descriptions of some of the company's principal products are given.

**'Pressure Blast' Equipment:** 176

**The Cro-Plate Co. Inc.**, 56 pages, spiral-bound catalog. Fully-illustrated catalog gives complete descriptive material on its line of manual, semi-automatic, and fully automatic "Pressure Blast" wet-blast equipment. Eighteen pages are devoted to illustrated case histories.

**Dye Penetrant Inspections:** 177

**Turco Products, Inc.**, 4 pages, 3-color illustrated folder. This semi-technical booklet is the first comprehensive report to be written about inspections by the dye penetrant process. Every aspect of penetrant flaw location — pre-cleaning, applying penetrant, removing excess, applying developer, and interpreting results — is fully discussed.

**New Drilling Machine:** 178

**Howe & Fant, Inc.**, 20-page illustrated brochure. Money-saving advantages of the company's new turret drilling machine are described. It covers initial cost, power and maintenance costs, floor space savings, set-up, handling, and down time plus a breakdown on estimated annual savings.


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| 4 | **How to clean aluminum before and after heat treating.** See page 20. |
| 5 | **How to strip paint from aluminum.** See pages 22 to 26. |
| 6 | **How to clean magnesium.** See pages 27 to 29. |
| 7 | **How to install cleaning tanks and spray-washing machines.** See pages 31 to 35. |
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## MIXER

*continued from page 64*

On the under side of the counter mounting plate, an aluminum casting is used (Figure 4). This is the receptacle for the speed control switch handle and a mounting means for the switch. As in the previous cases, only a casting could give the design and the rigidity required in this part.

Another functionally important feature for this casting, as well as for one of the gear box castings, is resistance to mild corrosion. Mildly corrosive materials are likely to be spilled into these recesses from time to time. Vinegar, citrus fruit juices, etc. would corrode a steel part rather rapidly unless it were protected by paint or were plated. Aluminum, on the other hand, will show no appreciable corrosion, provided the active agents are not allowed to remain in contact for long.

Through the use of a casting for this, service lugs can be provided on the bottom to mount the switch. With a drawn part, the only other logical method of fabrication, holes would have to be provided to accommodate machine screws. On the under side, spacers would be needed to position the switch properly and the assembly put together with at least three machine screws fitted with nuts and washers. From an inventory point alone, the use of a die casting is most desirable and, in addition, assembly is speeded and cost of fastening devices lowered.

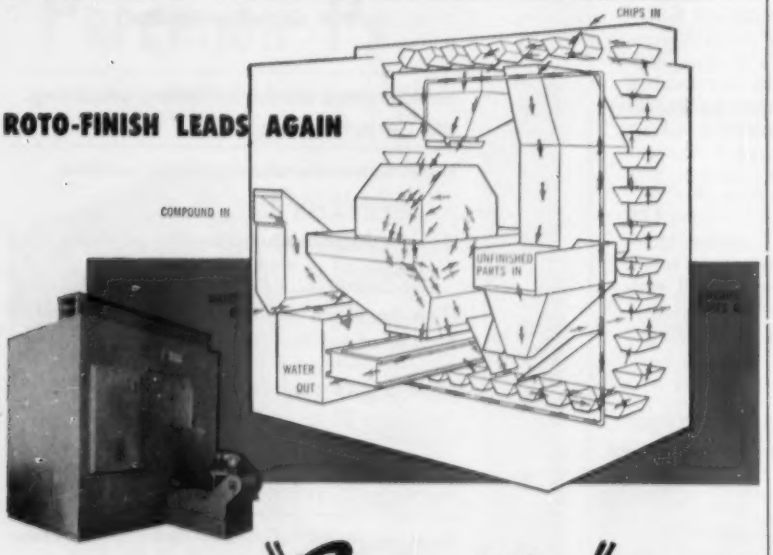
The bowl support mechanism consists of two castings shown in Figure 5. Because there is a possibility of food contact with these castings, they are made in aluminum. The lower casting is cast substantially complete. A light facing is required on the bottom to insure good matching with the machined surface in the attachment recess in the power unit. Three ears are provided which can be rotated under the cast lugs in the receptacle. Note that the top surface of these ears has a wedge shape to firmly lock the part in place.

Since the bowl support casting fits onto this lower casting and rotates on it, some method must be provided to prevent the two castings from separating. A groove is, therefore, machined into the shank at the time a light cut is taken to bring the shank to size. Here, dimensional tolerances are closer than can be economically cast. Again, it is important that this shank be precisely at right angles to the base of the casting so that correct alignment is always achieved. A clutch member fits into a machined hole in the bottom of the casting and is held in place by a small set screw which passes through the casting and engages a groove in the clutch. This clutch will be discussed more fully below.

The actual bowl support is shown in Figure 5. Another aluminum casting is used here again to prevent possible food contamination. As with most of the other castings used in this mixer, the particular shape is dictated by function and here the only method of securing the shape desired is through casting.

The roughly triangular shape of the outside of the pillar is required to hold the bowl in fixed position so that it cannot rotate independently. The hexagonal recess in the top of the pillar is required to accept a hexagonal


ROTO-FINISH LEADS AGAIN

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drive stud that is used to give positive rotation to the bowl.

Other than scratch brush polishing, the only work done on this casting is to ream the cored hole and press in a self-lubricating bronze bushing, and to drill, countersink and tap one hole for the set screw that prevents vertical motion between the two cooperating castings.

In Figure 3 is shown a cutaway view of the head assembly that carries the gearing for driving the beater blade and the bowl. The housing for this gear train is a pair of aluminum die castings. All of the various design and manufacturing considerations that have been discussed above are applicable to these two castings.

The strainer for the fruit juicer is another aluminum die casting, Figures 1 and 5. This casting appears to be quite simple, but actually represents one of the more difficult jobs that the die caster is called upon to do. As before, this casting is made in aluminum and finished by polishing only. The three rather long very small diameter legs present a problem in casting to insure complete filling of the cavities.

Two more zinc die castings complete those that are associated with the built-in portion of this appliance. These are the switch knob and a cover plate for the attachment receptacle. These two parts are shown in Figure 4. Both of these castings are made in zinc and finished by plating and painting. Both recesses are finished by painting. Through the use of a metallic paint, an attractive contrast is achieved while retaining the chromium plate color tones. All lettering and numerals are, of course, cast-in.

## INJECTORS

*continued from page 55*

The castings are furnished complete by the die caster except for tapping some of the holes. In the castings illustrated, the tall vertical body replaces a single barrel carburetor while the lower, right angle shaped casting, replaces a double barrel unit. An adapter plate, die cast in zinc, must be used when this injector replaces a four barrel carburetor. Also not shown is the fuel tank, a small cylindrical die casting that fastens to the side of the main body. In this unit, standard commercial tolerances are employed.

## DRIVE UNIT

*continued from page 62*

To hold the clutch part in position, allow it to rotate and prevent it from dropping out, a groove is provided into which the shank of a set screw fits. While this groove could be molded into the part during manufacture, the increased tooling costs and decreased production rates make it more economical to machine the groove after the part has been pressed and sintered.

A slot is provided in clutch half to accommodate a drive bar to assure positive rotation to the mixer blade spindle. This slot is formed in the piece during molding.


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## AIRCRAFT

*continued from page 50*

strengths for steel castings as compared to wrought products than can actually be achieved. Thus, size and weight penalties are imposed in the use of steel castings, a factor which makes it impractical for them to be considered for most aircraft applications.

The facts seem to be, the report goes on, that while many excellent steel castings of adequate strength and soundness have been made and are being made, all too often production lots of castings have been inferior or have shown wide variations in quality.

Reasons for this, according to foundry representatives, do not lie in a lack of basic knowledge. One claim is that presently prescribed testing procedures are unrealistic and often cause rejection of many usable castings because of minor detected irregularities which have no effect on essential mechanical properties.

It is true, they say, that only the highest skills and best practices in the foundry book are sufficient for the production of aircraft quality castings. The quality required by most commercial customers of the foundry, it is pointed out, is not adequate to meet the demands of the aircraft industry. These are the factors to be considered:

1. The generally small and infrequent orders for aircraft castings, often with a short delivery time and competitive bidding, do not encourage the foundry to set up special practices, train special personnel, and use different standards of control and inspection needed for these castings.

2. Most, but not all, of the aircraft makers select casting sources on a price basis. To make castings of the quality needed and demanded for aircraft might cost many times as much a similar sized castings for regular production in a jobbing foundry.

3. Some castings are very intricate in design and need considerable development work before they can be produced at all.

4. Designs of castings are fixed by the aircraft makers and patterns are made and submitted to the foundries. At this stage, the foundries hesitate to criticize the design of either the casting or the

pattern. But unsound design often leads to unsound castings.

Many foundries think the aircraft people are not seriously interested in using castings and in turn, the foundries are not particularly interested in accepting aircraft business.

This has created an impasse. The lack of confidence in castings which has developed in aircraft people from past experience and present discriminatory specifications tend to rule out steel castings from aircraft structures. On the other hand, the past procurement practices tend to rule out proper development of aircraft quality castings. It is this impasse, according to the panel report, which must be opened up before any notable progress can be achieved. Once this barrier has been eliminated, progress should be rapid.

**WHAT IS NEEDED?** The panel recommends four developments to open up the way to increased use of steel castings: 1) it must be proven that steel castings meeting needed strength-weight requirements and of consistent high quality can be made in production quantities, 2) comprehensive and realistic quality standards and applicable specifications for quality desired must be established, 3) acceptable testing procedures must be developed, and 4) designers and founders must become cognizant of each other's problems and work in close cooperation.

Conclusions and recommendations presented by the panel include the following:

1. Present activities (toward the four points outlined above) are insufficient and uncoordinated and will not provide the requisite data and mutual understanding leading to wider use of precision steel castings in aircraft.

2. Further development must be done with full cooperation between aircraft builders and foundries. Primary responsibility for design and testing final acceptance is with the aircraft manufacturers but efforts should be made to ensure that final designs are acceptable to the cooperating foundries and will permit optimum use of proper casting techniques. Development of requisite foundry controls and practices and production of acceptable castings is a responsibility of the founder.

3. The Government should sponsor and subsidize a broad and flexible development program aimed at establishing the acceptability of steel castings for aircraft use and of determining the best methods for production of steel castings of consistent high quality.

4. Basic investigations, particularly relating to foundry controls and techniques, mold materials and casting alloys, should be continued, broadened and accelerated.

5. New and comprehensive quality standards must be developed. Current testing procedures should be reviewed and new ones developed if necessary.

6. A coordinating or steering body should be established to furnish advice and to monitor progress on these research and development projects, including evaluation and testing phases.

## OPEN BUFFALO WAREHOUSE

The Carpenter Steel Co. has opened a new and larger mill-branch warehouse in Buffalo to service users of tool, alloy, and stainless steels in western and central New York and northern Pennsylvania.


SPECTROGRAPHIC EQUIPMENT for Metal Analysis by Baird—Atomic

*Baird-Atomic offers a complete line of spectrographic equipment for the analysis of metals in production and fabrication.*

*B-A instruments provide rapid, accurate analysis . . . simple, stable operation, trouble-free economical performance.*

**The Direct Reading Spectrometer**

Quality-control analytical laboratory for production and research. Simple, rapid operation — forty seconds for complete analysis on dials reading directly in percent concentration. Permanent optical alignment with the Automatic Servo Monitor. Other features include: unique (patented) measuring system . . . plug-in components assuring continuous operation . . . rugged design for plant operation . . . and versatile specimen holders.

**Spectromet** Designed for production-floor operation by non-technical personnel. Sealed housing provides complete environmental protection of optical and electronic systems. Spectromet provides rapid direct-reading results, extremely simple operation. No critical adjustments. Automatic Servo Monitor for permanent optical alignment. Analysis of eight elements in 40 seconds.

**Complete Spectrographic Laboratory**

Baird-Atomic, a pioneer in the emission spectrographic instrument industry, offers a complete line of equipment for a spectrographic laboratory. Over twenty years of experience and design are incorporated into the following components: Three-Meter Grating Spectrograph, with its 20-inch camera; Double Beam Densitometer Comparator, employing an optical null-balance system and allowing for direct density measurements on a linear scale; Calculating Board, to easily translate densitometer readings into percent concentration values; and Spectrographic Source Unit, whose versatility supplies a full choice of excitation conditions for all emission problems.

*Complete Technical Information Available Upon Request.*

BAIRD ATOMIC *Baird Associates—Atomic Instrument Co.*

33 UNIVERSITY ROAD, CAMBRIDGE 38, MASSACHUSETTS

*Westinghouse pilot plant for precision castings speeds development, saves capital investment*

# Proving ground for castings

Now . . . without heavy capital investment . . . you can prove your ideas and developmental work for molded metal products.

Modern pilot plant facilities are available at the new Westinghouse metals plant, Blairsville, Pa., to help you explore full production conditions and create prototype quantities. Here you can compare conveniently all types of castings at one place from the same heat.

Open production capacity is also available for fast, dependable delivery on precision investment castings (lost wax process), shell-mold castings and powder metal parts.

In making a value analysis of your product components, consider molded metal parts for pieces involving intricate shapes, close tolerances, difficult machining operations or component assemblies. You save machining, improve finishes, reduce rejections.

*Send today* for further details and a copy of DB 52-500. Also enclose a photo, drawing or sample of the part you want evaluated. No obligation. Westinghouse Electric Corporation, 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-05001

**WATCH WESTINGHOUSE!**

*WHERE BIG THINGS ARE HAPPENING TODAY!*

*For more information circle No. 93 on the Reader Service Card*


## TO HEAR PROGRESS REPORT ON VACUUM DIE CASTING

A report on the progress that has been made in vacuum die casting will be presented before the Cleveland chapter of Society of Die Casting Engineers at its regular meeting, November 20. David Morgenstern of Nelmor Manufacturing Co., a developer of vacuum die casting methods, will speak on "Vacuum Die Casting—Today and Tomorrow." Mr. Morgenstern will report on present status of the process, where it is being used, what problems have been encountered and what is being done.

The SDCE chapter which meets regularly at Kiefers' Restaurant, 2519 Detroit Ave., Cleveland, last month heard a panel discussion of heat treating problems encountered in die casting dies and what to do about them. Speakers included John Vanis of Euclid Heat-Treating Co., Al Pagel of Ferrotherm Corp., and John Walker of Walker Heat Treating, Inc.

## BUILDS WESTERN WAREHOUSE

Vanadium-Alloys Steel Co. has established a new West Coast firm to distribute warehouse stocks of high speed and tool steels, according to Burns George, vice president in charge of sales. The new firm, Vanadium-Pacific Steel Co., will be based in the Los Angeles district at Maywood, Calif.

## NAME PHILADELPHIA AGENT

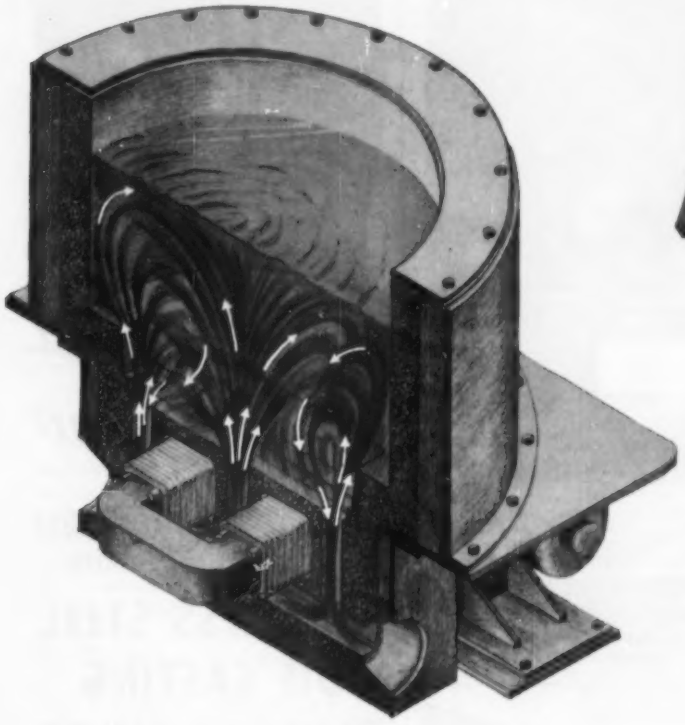
The Uddeholm Co. of America, Inc., New York, N. Y. has announced the appointment of a new district sales representative for their Swedish tool and special strip steels. Frank T. Campagna, 34 South 17th Street, Philadelphia, will represent Uddeholm in Philadelphia territory.

## FRANCIS LORDI APPOINTED

Francis D. Lordi has been appointed a development engineer in General Electric Company's Foundry Department Applied Research and Development Lab.

According to Dr. Jack Keverian, AR&D laboratory manager, Lordi will work on foundry development programs concerning present technical problems, as well as the development of new foundry processes and materials.

# *The Furnace that Stirs Itself !*



## ELECTROMAGNETIC PRESSURE CIRCULATES MOLTEN METAL

*— In this 60 Cycle —*

**AJAX** TAMA-WYATT *Induction Furnace*

Heat is generated only in the melting channels. Controlled stirring *(neither too much nor too little)* guarantees uniformity of metal temperature and alloy composition and also leads to efficient melting of light scrap. Tiresome puddling is eliminated. The metal is held entirely in an inert refractory lining. The atmosphere is cool and free from contaminating gases.

### *No Other Method Enables such Completely* CONTROLLED MELTING

Today, AJAX builds a complete line of these time-tested furnaces in standard sizes up to 333 kW for the dependable melting of aluminum, brass, copper and zinc. Units for special applications are carefully engineered to specifications.

## TWIN COIL INDUCTORS

### *Lead Non-Ferrous Melting*

The sectional view above shows the twin coil stirring action of the 100 kW Ajax-Tama Wyatt 60 cycle induction furnace. Heat induced in the secondary channels below is conveyed throughout the melt by electromagnetic circulation as shown by the arrows. The 100 kW furnace shown here, is one of a family of twin coil furnaces available today for melting rates from 300 to 10,000 lbs. per hour.

*For Further Information, Send For Bulletin R-43*

**AJAX ENGINEERING CORP., TRENTON 7, N. J.**

**AJAX** TAMA-WYATT = INDUCTION MELTING FURNACE

AJAX ELECTRO METALLURGICAL CORP., and Associated Companies
AJAX ELECTROTHERMIC CORP., Ajax Northrup High Frequency Induction Furnaces
AJAX ELECTRIC CO., The Ajax Wolfgang Electric Salt Bath Furnace
AJAX ELECTRIC FURNACE CORP., Ajax Wyatt Induction Furnaces for Melting

*For more information circle No. 5 on the Reader Service Card*

For more information circle No. 54 on the Reader Service Card

# Precision Unlimited!

**No job or part is too big or too small**

• Peerless die casts a limitless variety of precision parts of almost any size or shape to the most exacting specifications in strength resistance, weight, finish, dimensions and contour. Massive machine parts down to infinite precision control parts receive the same trusting, dependable handling by Peerless.

## Peerless

PEERLESS DIE CASTING AND PERMOLD

A DIVISION OF PEERLESS ALUMINUM FOUNDRY COMPANY, INC.
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Eliminate Casting Problems . . . Use

# 3-C* PLASTICS

REPLACE WAX IN INVESTMENT CASTING

**Produce Excellent Results with Present Equipment**

- **NO DIE LUBRICANTS REQUIRED**
  Non-adhesive. Easily removable without streaks or distortion.
- **FLEXIBLE-RESILIENT**
  Eliminates need for special care when removing patterns.
- **HIGHEST LUSTRE FINISH**
  Gleaming surface reproduces finest details accurately.
- **ELIMINATE POROSITY AND SURFACE IMPERFECTIONS**
  Flows smoothly within a wide temperature range. Homogeneous mass.

*Write today for further information*

*Reg. U.S. Pat. Off.

"EVERYTHING FOR CASTING"

**CENTRIFUGAL CASTING SUPPLY CO.**
147 WEST 42nd STREET • NEW YORK 36, N. Y.

For more information circle No. 99 on the Reader Service Card

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# THIS PLUNGER RING CAN SAVE YOU MONEY . . . TIME and Eliminate Lost Production

## Precision UN-BREAKABLE TEMPERED and TREATED STAINLESS STEEL DIE CASTING PLUNGER RINGS

• The response to Precision's Stainless Steel Die Casting Rings has been tremendous. 75 new customers in 3 months. The reasons are obvious.

Precision Un-Breakable Plunger Rings are made of tempered and treated stainless steel. They are wrought, *not cast*, from dense, fine grain, flawless stainless steel. Engineered specifically for die casting machine applications, Precision Stainless Steel Plunger Rings give up to 8 to 10 times the average life of other rings. Produced under the most exacting methods, uniform tension and resiliency with long wearing, un-breakable and heat resistant qualities make it possible for plunger, groove and sleeve tolerances to be greater, thus eliminating unnecessary wear. Precision Rings are designed to allow for expansion under extreme heat and this feature with the characteristics of the stainless steel assures the finest, most dependable die casting plunger ring made.

Rings can be supplied in ¼" widths from 2¾" diameter up. They can be made to special diameters and widths.

Write for Precision's special bulletin on the stainless steel die casting plunger rings.

Precision's Engineering Department will gladly make recommendations on rings for your die casting plungers.

**Precision PISTON RINGS, inc.**

Sales Offices: INDIANAPOLIS—CHICAGO—LOS ANGELES—SAN FRANCISCO—NEW YORK—PHILADELPHIA

Circle No. 56 on the Reader Service Card

## BUSINESS MACHINES

*continued from page 59*

Shell-molded castings are welcomed in the machine shop. Compared with conventional green sand castings, they offer many advantages in machining operations. The dimensional tolerances maintained by the process facilitate jigging for high-speed, high-production machining.

The absence in shell-molded castings of the customary oriented grain structure allows very shallow or tapering cuts to be made. This is in contrast to the necessity in conventional green sand castings, for taking the first cut sufficiently deep to cut "under the skin".

Other machining advantages of shell-molded castings are that the sounder internal structure results in fewer castings being found defective after partial machining has been completed. Tool life is increased, further reducing machining costs and minimizing down time due to sharpening. Machine operators invariably report easier machining with shell than with green sand castings.

The excellent dimensional tolerances allow not only for reduction in machining effort but also minimize the need for expensive machining equipment. Based on the machining of solid parts, approximately 50 percent reduction of time is achieved if the machining operation can be reduced to a rough drilling followed by a reaming operation. In the majority of shell molded castings where reaming only is required, the resultant saving in machining effort is approximately 75 percent.

The main contribution which shell molding made was in keeping costs of finished parts to a minimum. The Whitin Masterlith Duplicator is extremely rugged in design. Castings were specified in many components where stampings or weldments might ordinarily have been used in machines of this type which were not designed for such long and hard use.

Nonetheless, the Whitin Duplicator still is expected to compete in the same price range as similar machines, its rugged design being an added sales mover in addition to its versatility and accuracy.

By producing castings to close tolerances with resultant reduction of machining requirements and by producing cast parts of a sound, uniform grain structure, shell molding helps to reduce the manufacturing costs of the machine and allow its introduction into a highly competitive market at a truly competitive price.

### ALCOA BOOSTS OUTPUT

Aluminum Company of America's installed producing capacity for primary aluminum will near the million-ton-a-year mark with the construction of a seventh electrolytic potline at its Point Comfort, Tex., works. January, 1958 is the target date for production from the new line which will add 20,000 tons to that plant's present capacity of 120,000 tons annually.

The company's Warrick, Ind., works, now under construction, will offer 150,000 tons of new production and, coupled with the Point Comport output, will bring Alcoa's total installed capacity to 962,500 tons annually.

YESTERDAY
TOMORROW
The Trend is with Badger...
BADGER quality makes your product more competitive!
• Zinc and Aluminum Die Castings •
BADGER
DIE CASTING CORP.
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# NEW PRODUCTS AND DEVELOPMENTS

*Want complete details on these announcements? Use the Reader Service Cards. You'll find them facing page 16 of this issue*

## AUTOMATIC STUD DRIVER ADAPTS TO THREE HEADS

A recently introduced automatic stud driver is easily adaptable to from one to three heads.

Since the heads can be spaced as closely as 2½" center to center, they are easily integrated into automated index tables or conveyor lines.

The heads of the model SD10-2 unit are individually driven by ½ h.p. motors, a.c., d.c., or air torque, and are fitted with air-draulic or hydraulic connections. Self-opening chucks, which are positive in drive, grip and release the studs without screwing out the driven studs.

**Syracuse Special Machine Co., Inc.**
For more information, circle No. 188 on the Reader Service Card

## HIGH SPEED POLISHING LATHE FOR AUTO & AIRCRAFT PARTS

A new, high speed polishing lathe with shortened spindle, for hand finishing small automotive and aircraft parts and jet blades has been announced.

The lathe uses a 5 h.p. motor and has a speed up to 6500 r.p.m. Designated as the Model 5-ROL, it has a dynamically balanced, ball bearing spindle, with either flat or multi-V-belt drive, and the motor is mounted inside a heavy, cast iron base.

A combination brake and switch, operated by a single lever, instantly stops the lathe spindle and cuts off the motor current before the brake is applied. The brake also locks the spindle for wheel removal.

**Hammond Machinery Builders, Inc.**
For more information, circle No. 182 on the Reader Service Card

## HYDRAULIC COMPACTING PRESS PRODUCES UNUSUAL SHAPES

A new, hydraulic, metal-powder compacting press enables fabricators to produce — without additional tooling — such shapes as a double counterbore and a double hub, or variations of these.

This Model 390-H is a 300 ton, four-column, hydraulically operated press with the main pressing platen moving down from the top. The main platen exerts a force of 300 tons and the four auxiliary cylinders can be adjusted to a miximum pressure of 125 tons.

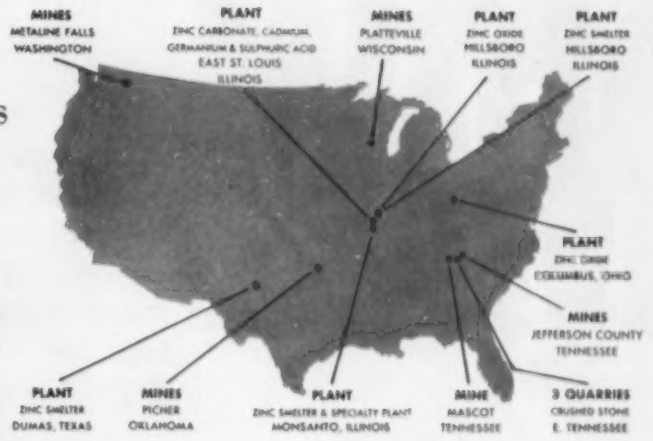
The die platen, held in its top position by two air cylinders, is equipped with adjustable stops to limit its downward movement. The ejector platen is operated hydraulically with a maximum force of 300 tons. The floating core rod can travel with the part during ejection, until the part has cleared the die and expanded enough to release its hold on the rod.

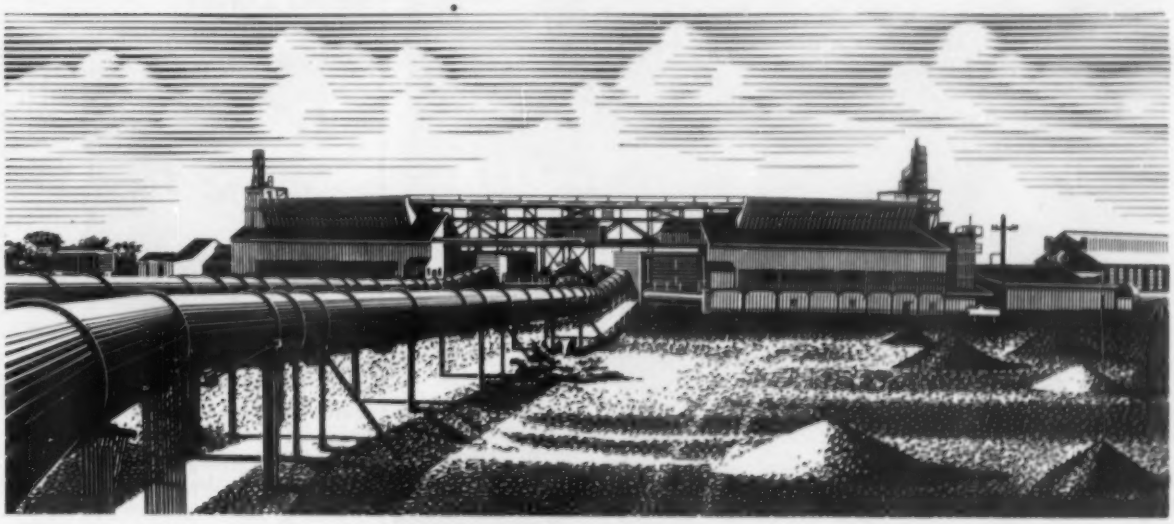
A complete functional description including progressive schematic diagrams of punch and core-rod movements during the compacting stroke are available from the manufacturer.

**Baldwin-Lima-Hamilton Corp.**
For more information, circle No. 183 on the Reader Service Card

*Continued on page 94*

# American Zinc and its products *from* A *to* Z



**DUAL OPERATION AT HILLSBORO, ILLINOIS**

(1) The Oxide Division supplies American process lead-free and leaded zinc oxide, as well as French process zinc oxide. (2) In the Metal Division, Prime Western, Select, Brass Special, Intermediate and High Grade slab zinc are produced. For complete picture of American Zinc operations, see map above.

**PRODUCERS OF**

ALL GRADES OF SLAB ZINC
ZINC ANODES (Plating & Galvanic)
METALLIC CADMIUM
SULPHURIC ACID
LEAD-FREE and LEADED ZINC OXIDES
ZINC CARBONATE
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*For more information circle No. 9 on the Reader Service Card*

# NOW

**...a larger furnace to produce investment castings up to 20 lbs.**

Here's the new, larger, direct casting furnace, for investment castings up to 20 pounds. It has all the features and advantages of Detroit Electric's successful, 10-pound IC furnace, which is producing high quality castings for many exacting uses.

The new ID Furnace features fast, indirect arc melting. Metal analysis is maintained without carbon contamination from the electrodes. The mold is clamped to the furnace when metal is ready and the mold is poured simply by inverting the furnace.

*Let us tell you the complete story of operation and production advantages of the new ID Furnace. Write or call today.*

**DETROIT ELECTRIC FURNACE DIVISION**

**Kuhlman Electric Company • 1070 26th St., Bay City, Mich.**

***For more information circle No. 41 on the Reader Service Card***




## *RHODIUM PLATING PROCESS . . . stops peeling, curling*

A new plating process, which is said to produce compressively stressed deposits, eliminates curling, cracking, and peeling common in conventional rhodium electroplate. Called Rhodex -CS-, the process is of special interest to electrical and electronics manufacturers who have had reject problems due to rhodium's high tensile stress characteristics.

**Sel-Rex Precious Metals, Inc.**
For more information, circle No. 184 on the Reader Service Card

## *SWING SANDER . . . has adjustable arm*

A new swing sander features a tension arm and abrasive belt drive pulley which move backward and forward freely under balanced spring controls.

Equipped with a ¾ h.p., 1750 r.p.m. motor, the unit operates with oscillation of the entire motor. The tension arm support and tension arm are controlled by adjustable stops. This automatic tension arm instantly compensates for belt stretch and has a quick tension release mechanism for easy belt change.

The motor utilizes a V-belt drive to a 10" abrasive belt drive pulley. Specifications include: working height 42", table 24" x 32", overall dimensions 62" x 48" x 24".

**Bush Manufacturing Corp.**
For more information, circle No. 189 on the Reader Service Card

## *AUTOMATIC DRILL MACHINE . . . for automotive parts*

Incorporating five automatic drilling units, together with a power saw, a new machine drills, tap drills, taps, taper reams, slots, and deburrs automotive parts in the order stated.

The machine is reported to

perform the six operations on 700 parts per hour. The operator merely clamps the part in the machine; all operations, including clamping and ejecting, are then performed automatically. By making changes in the number and arrangement of the drilling units, the machine is adaptable to a variety of operations.

**Govro-Nelson Co.**
For more information, circle No. 186 on the Reader Service Card

### STEEL DRILL BLANKS ... in 182 sizes

Hardened, high speed steel drill blanks in 182 standard stock sizes are now available for use as knockout pins, punches, dowel pins, gages and rollers for high temperature applications.

In addition, the drill blanks are also adaptable on the job to form a variety of end-cutting tools. Blanks up to ½" diameter are supplied in standard drill lengths with a tolerance of .0002, while those over ½" through 1" diameter are furnished in standard 6-inch lengths with a .0005 tolerance.

Also, 36-inch lengths are available from stock in diameters from 3/32" through ½" in step series of 1/32".

**Ace Drill Corp.**
For more information, circle No. 185 on the Reader Service Card

### PORTABLE DUST COLLECTOR ... features compactness

A new, square-type, portable dust collector captures dust from medium size grinding equipment and performs efficiently with drill presses, lathes, milling machines, surface grinders, etc., when these tools are used for high speed machining of cast iron.

Known as the Model 40 Dus-Kolector, the unit uses a ½ h.p. motor and can be "tucked in" around machine tools due to its compact cabinet size. A shaft with hand knob provides convenient means of "shaking" filters for cleaning, without removing them from the cabinet.

A front panel is easily removed for access to the replaceable fiber glass filters and dust pan in the bottom of the cabinet. With two inlets, the dust collector has a capacity of 700 c.f.m. and can be used with two 16" x 2" grinding wheels or two 4" wide abrasive belts.

**Hammond Machinery Builders, Inc.**
For more information, circle No. 194 on the Reader Service Card


For more information circle No. 8 on the Reader Service Card

speaking of quality...

PREALLOYED STAINLESS STEEL POWDERS

by AMP

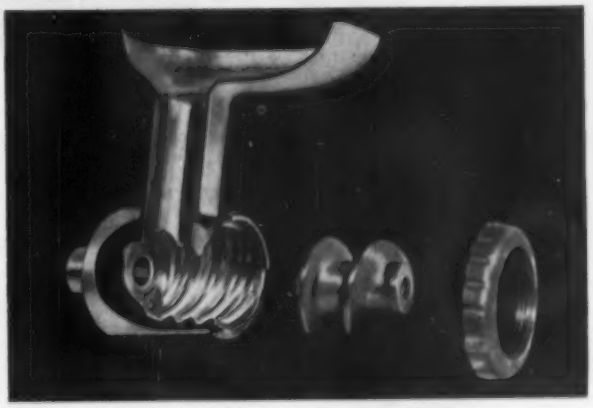
For Outstanding Structural Parts, Porous Media and Self-Lubricating Parts Requiring Any or All of These Properties . . .

- SUPER-CORROSION RESISTANCE
- HEAT RESISTANCE
- HIGHER DENSITY
- HIGH DEGREE OF HARDNESS
- HIGH IMPACT STRENGTH
- HIGH TENSILE STRENGTH

9 Standard AISI Alloys To Choose From

WRITE TODAY FOR FULL DETAILS

ALLOY METAL POWDERS, INC.
producers of
prealloyed metal powders and pigments
234 EAGLE STREET • BROOKLYN 22, NEW YORK



With proper engineering and die cast technique, threads are cast to size with the typical aluminum die cast smooth finish.

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For more information circle No. 29 on the Reader Service Card

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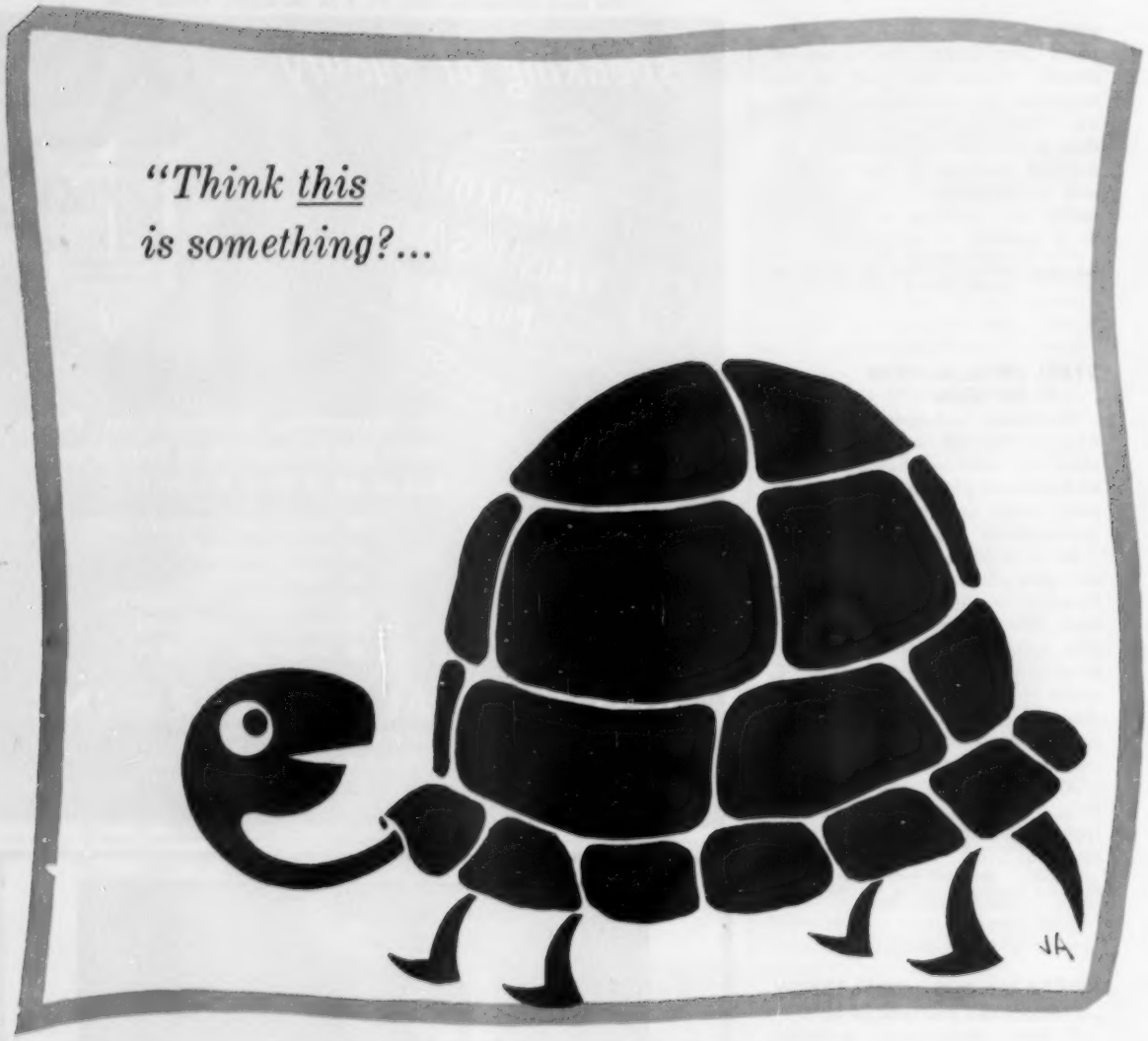

*you ought to see what you can do with*

# Plenco shell molding resins"

PLENCO PHENOLICS
FOR BETTER PLASTIC PRODUCTS

**PLASTICS ENGINEERING COMPANY**
Sheboygan, Wisconsin

We're not sticking our necks out when we say there can be definite economic and production advantages for you by shell molding with dependable, versatile Plenco resins. Many a foundry can vouch for that statement. Their profitable experiences with Plenco engineering and research are being repeated every day. Why don't you investigate?

Serving the plastics industry in the manufacture of high grade phenolic molding compounds, industrial resins and coating resins.

*For more information circle No. 55 on the Reader Service Card*

## TWO DRILL PRESSES
### . . . for production, shops

New 15- and 20-inch drill presses—first of their size in the Delta line—have recently been introduced.

Primarily a production-line tool for metalworking, the 15-inch press's versatility and low cost make it suitable for small commercial shops. The 20-inch press is primarily a metalworking production tool but can be used in tool shops, maintenance departments, and model shops.

The 15-inch unit features six different spindle adapters and a multi-speed attachment for special operations such as reaming at slow speeds and small hole drilling at high speeds. Slow and high speed models offer a range of 470 to 4,600 rpm. Powered by a 1/3 or 1/2 h.p. motor, the press has a spindle travel of 4 5/16 inches.

In addition to a depth gage on the depth stop, the 20-inch drill press has a quick-set depth gage on the pinion with a zero-start feature and a magnified scale for easier reading. Speeds range from 260 to 1760 rpm with a 1140 rpm motor, or 400 to 2600 rpm with a 1725 rpm motor. Spindle travel is 6 inches with a heavy duty, adjustable spring return.

**Rockwell Manufacturing Co.**
For more information, circle No. 195 on the Reader Service Card

## FIRE RESISTANT FLUID
### . . . for special applications

A new fire-resistant, hydraulic fluid has been developed for systems operating above 150 F and for heavily loaded pumps and bearings.

Known as Houghto-Safe 1020, the fortified synthetic material is a companion to the water-based Houghto-Safe 620 now in service. The fluid is fortified with rust preventives and anti-foaming agents and is said to give greater film strength and lubricity.

**E. F. Houghton & Co.**
For more information, circle No. 187 on the Reader Service Card


*For more information circle No. 1 on the Reader Service Card*

**NEW!**

**HIGH SPEED A.B.C. DIE CASTING MACHINE**

**Free Cycles Over 1000 Shots Per Hour**

**Here's the new A·B·C high speed, low cost die casting machine which eliminates costly production of small die castings on large die casting machines. Air operated, the machine produces small non-porous lead, tin and zinc alloy precision die castings up to 1½ lbs. The A·B·C is economical to operate and easy to set up. Its lightning production speeds makes single cavity molds practical and profitable.**

**STANDARD EQUIPMENT INCLUDES:**
- 4 TIE BARS
- AUTOMATIC TIMING
- CALIBRATED TEMPERATURE GAS CONTROL
- GAS BURNERS
- DIE BLOCKS
- AIR REGULATOR
- FILTER
- OILER
- SAFETY SHOT INTERLOCK

*Write today for engineering data and prices. Ask for bulletin A-10.*

**A B C DIE CASTING MACHINE CO.**
400 E. 142nd ST. • DOLTON, ILL.

**aluminum . . .**
- permanent mold castings
- die castings

Military Specifications
Intricate Design
Consult Us On Your Requirements

**EASTERN CASTING CORP. DIVISION**
THE EASTERN MALLEABLE IRON CO.
64 South William Street, Newburgh, New York
*For more information circle No. 27 on the Reader Service Card*

### CUTTING MATERIAL
**. . . for high speed work**

Recent field tests of a new metallic cutting material have shown that it can be run successfully at speeds beyond the range of present day machines.

Called NewMet, the cutting medium has molybdenum and titanium as its major constituents and is said to be harder than conventional carbides, easy to braze and impervious to cratering and wear.

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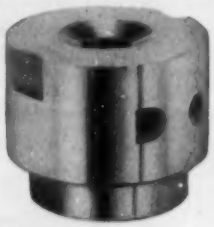

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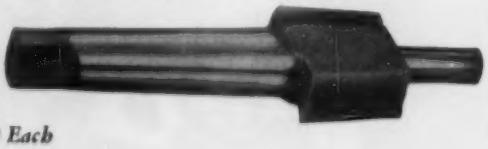

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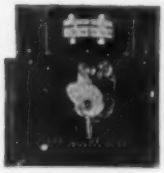

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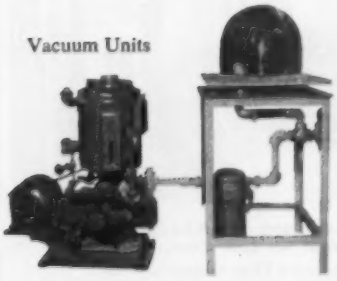

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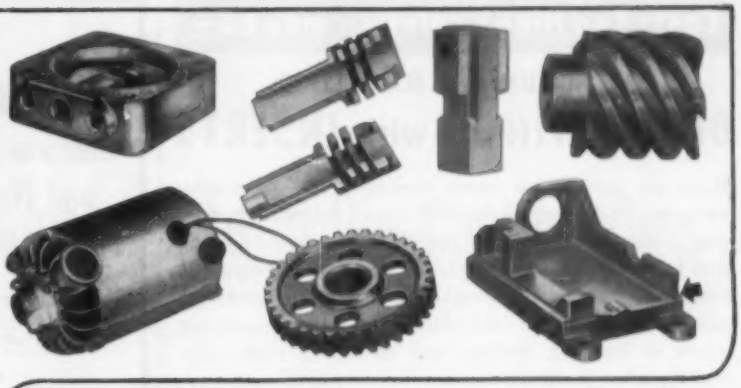

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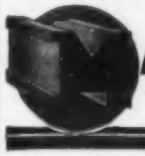

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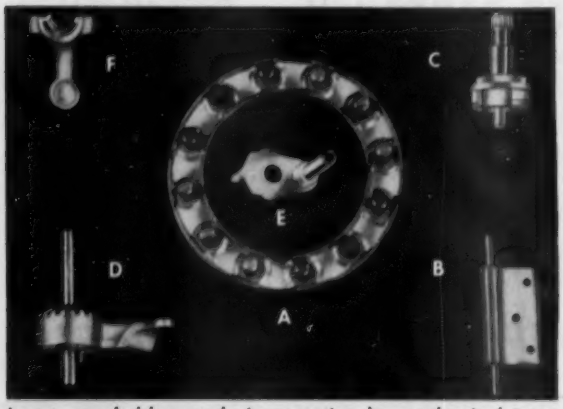


Inserts are held securely in a casting by mechanical interlocking with the cast metal. The shrinkage of the cast metal as it cools makes the metal grip the insert firmly. Sometimes inserts are used to eliminate machining operations on castings.

Frequently curved passages inside of a casting which are impossible to core can be formed by inserting bent tubes. Sealed heating elements gain exceptionally good protection against abuse and excellent heat transfer characteristics when die cast as inserts.

The broad scope of uses for die castings with inserts is indicated in the photo above, which includes: **A**-fuel cell opening reinforcement ring with cast-in steel dome nuts; **B**-hinge for outboard motor cover with cast-in steel shaft; **C**-window regulator rotor with cast-in steel shaft; **D**-throttle control gear with cast-in brass shaft; **E**-phonograph control arm with cast-in brass tube; **F**-refrigerator compressor connecting rod with cast-in bronze bearing.

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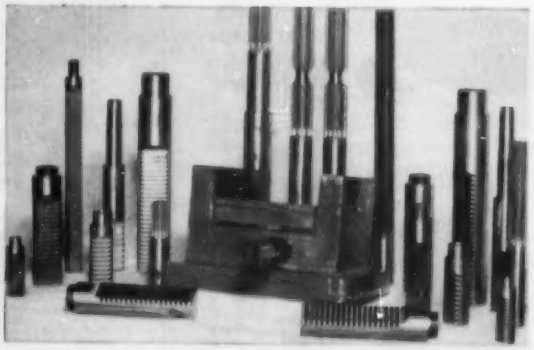

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# How To Control Temperature In Die Casting Dies

## Part 5 – Die Design For Heat Control

By W. M. HALLIDAY

WITH most die casting dies the chief region likely to suffer large temperature flutuations, and thus requiring careful thermal regulation, is the cavity matrix and the metal mass immediately around it. At each 'shot' almost the whole of the molten charge comes into intimate contact with the cool walls of the cavity. The result is an unavoidable tendency towards a continuous *build-up* of heat in this region by normal transfer of heat from the alloy.

As already explained in the first portion of this series, (See PMM, July 1956.) there is also an alternating process of *heat-loss* from this same region due to radiation to the colder and more remote portions of the die metal mass; and also by dissipation of some heat to the atmosphere. These successive heat-losses normally occur during the repetitive ejection cycles when the die is opened.

The heat in this critical region has invariably to be closely regulated so that such temperature alterations are kept as small as possible. To obtain successful working results it is essential that the cavity walls be maintained at a sufficiently *low temperature* to ensure the rapid solidification of the alloy charge in order that ejection of the finished die casting

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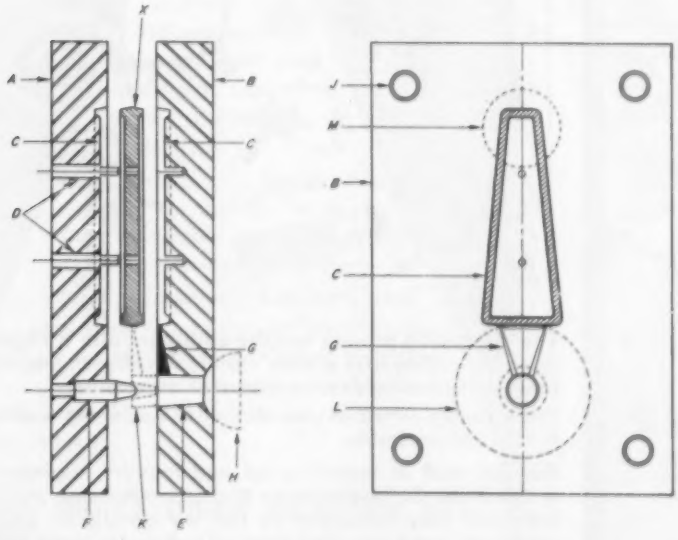


**1. HEAT-REGULATION PROBLEMS** are illustrated, occurring with a die of admittedly simple design for producing a tray-like casting *X*, which has considerable surface area but an exceedingly small section thickness.

The die construction comprises the rectangular blocks *A* and *B* of identical size but of unduly thin cross-sectional thickness. *C* are the cavity forms—of equal size and shape-cut into the parting joint surface of each block. The die parting therefore lies transversely around the outer bossed-up edges of the casting.

Members *D* are cylindrical cores affixed within movable block *A*. They project across the cavity area to pass into blind guide holes in the mating block *B* when the die is closed for injection. The short conical sprue channel *E* through stationary block *B* lies perpendicular to the parting-joint surface of that block. A sprue distributor-pin *F* is mounted in movable block *A* to pass into the sprue channel in the customary manner.

The alloy charge feeds into the cavity through an end-gate situated along the square endwall at the lower end of cavity form *C* in block *B*. A simple fan-type runner *G* connects this gate to the outlet end of the sprue. The diagram at the right giving a view along the parting-joint surface of member *B* clearly illustrates this simple runner/gate lay-out. Finished casting *X* is stripped off fixed cores *D* by a set of ejector-rods which slide through block *A*. The application of such ejectors will be well understood, hence such elements are omitted from the attached diagrams.

Light broken lines *H* denote the injection-nozzle bearing against the spherical seating at the rear end of the sprue. The die-blocks are positioned by four standard dowels *J*—one in each corner—to maintain the alignability of the two matching cavities *C*. Broken lines *K* depict the sprue and runner waste adhering to the ejected casting.

may be accomplished as speedily as possible after each injection 'shot'.

Efficient control of die heat over this critical zone is often far from simple to achieve because of numerous other factors. For instance, the die design, especially in respect of cavity shape or complexity of lay-out; the volumetric magnitude of the cavity; the rapidity at which injection strokes are performed, and the interval necessary in-between such injection 'shots' for opening the die to eject finished castings, often lead to considerable heat imbalance and render its correction difficult and protracted. These factors are also closely inter-related which means, in practice, that an alteration to any single one, may produce a corresponding alteration in several others.

Where the die cavity is subject to such considerable temperature fluctuations the usual outcome is the development of puzzling irregularities in the finished die cast parts and/or the creation of grossly adverse working conditions in the die itself. The effect is either to slow down the casting cycle or to cause other faults on the casting . . . or both.

The difficulties generally experienced in establishing a stable correct working temperature at the cavity zone stem largely from the shape, size and contours of the cavity itself. For example, if the cavity form is exceedingly complex involving a combination of thick and thin wall sections which abut suddenly and closely to each other or where large, massive cores intervene in the cavity area, it is often difficult to install effective means for promoting satisfactory heat diffusion so that the thermal imbalance is redressed in the best practical manner.

Similarly, the nature of the alloy, its fluidity and working temperature for casting, the velocity of the flowing charge of alloy entering the die, the lay-out and particularly the intricacies of runner channels or other feeding provisions, and the length of the ejection cycle may all contribute to the difficulties in the way of ensuring a uniform heat distribution and stable temperature throughout the cavity region.

The total effect is to vary (often very substantially) the time required for the molten alloy charge to flow through the die channels and into the cavity. As explained in an earlier section, the length of time the alloy charge remains in contact with the surfaces of the die during the feeding stroke largely determines the *rate of heat* transfer occurring from the hot alloy charge to the much cooler wall surfaces of the die.

*The most successful heat control means are those specifically introduced into the design and construction of the die from the very outset of its development.* This method ensures that die metal may be distributed, massed and proportioned correctly to meet the known heating tendencies to be counter-acted. Likewise, this method of pre-planning *every design feature* from the beginning enables water-cooling provisions to be located most strategically in relation to the cavity lay-out, movable or fixed cores, ejectors, air-vents and all similar essential working elements in a die.

*Continued on page 104*

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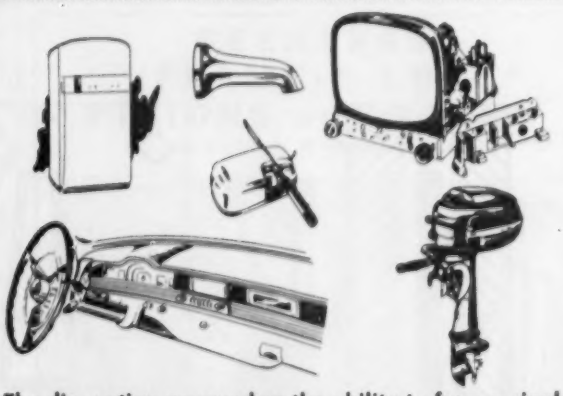

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*By F. S. Ross, Vice-President in charge of Engineering Centr-O-Cast and Engineering Co.*

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Often when a die has been designed and finally constructed without proper attention to its heat-regulation requirements, difficulties will be encountered in introducing heat stabilizing features which are revealed as necessary by the proving tests. The die blocks may have been finally heat treated and hardened-off; cores have been fitted together with operating mechanisms; the runner lay-out and gating system has been finalized, and so on.

One of the simplest expedients available for facilitating heat distribution over the cavity region and to established a useful measure of control over temperature fluctuations, is that of adjusting the metal mass contained in the die blocks adjacent to the hottest or coldest portions. Within certain practical limits, it is frequently feasible to reduce or increase the metal mass in given portions of the die blocks to counteract over-rapid radiation from the cavity and sprue zones or alternatively, to retard that condition.

The diagrams in Figures a and b illustrate the possibilities attaching to this method, and show both the practical advantages to be gained and the limitations. The method is not applicable to all types of dies; it is in fact difficult to adopt where the die blocks have been completely finished and hardened.

When operating a die of the conventional construction shown in Figure 1, where the die blocks are exceedingly thin, but contain very shallow cavity forms having a large superficial surface area; the external surfaces of the blocks surrounding the sprue/runner channels, as denoted at *L* will be the hottest region in the die.

As injection progresses, region *L* tends to reach a high temperature by its absorption of heat from the flowing charges and because of its closeness to the hot injection-nozzle. No comparable scale of heating occurs, however, in the uppermost reaches of such a shallow cavity form around region *M* owing to the relatively small volume of molten alloy which flows therein, and the unavoidable drop in its temperature during its passage along the cavity.

On the other hand, heat-losses from sprue region *L* may be considerable and occurring at an al-

most equally rapid rate as the heat input at that point. Because of the extreme thinness of the die blocks such heat-loss occurs by reason of normal radiation to the atmosphere from the external surfaces of the die blocks, especially with the stationary member *B*.

The transfer of heat through such a thin block section in a direction running parallel to the parting-joint and towards the end of the cavity farthest removed from the sprue/runner area, is thereby still further reduced by the heat-losses. This condition results in the development of appreciable temperature alternations and a gross lack of uniformity of die heat over the critical cavity regions. A considerable disparity is unavoidable between the heat input at the sprue and the remoter regions *M* of the cavity.

The resulting undersirable heat fluctuations and the inability to maintain a correct working temperature over the entire cavity region may be ameliorated by the adoption of either of the following two expedients.

**Additional heat may be applied**—from some externally located source—to the upper region *M* in both die blocks. This would counteract to some extent the losses at the external surfaces of the die by normal radiation. The method would not be wholly successful, however, and with most dies would certainly be troublesome and costly to install.

Electric heating elements, in the form of bands or cartridges would have to be attached to or built into the respective die blocks. The chief difficulty with this method lies in establishing a uniform heat over the critical portions of the die, a condition not easy to achieve when there are two main sources of heat input.

**The mass of metal in the die blocks may be increased** by affixing thick backing plates—one to the rear of each member. This addition of metal mass would permit the heat developing around the sprue region *L* at each injection 'shot' to dissipate more easily and smoothly throughout the surrounding mass. Thus the heat diffusion rate would be reduced. It would also tend to reduce heat loss to the surrounding air from the external surfaces of the die

*Continued next page*


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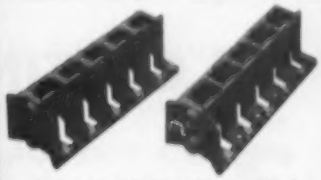
**VISUAL PROOF**

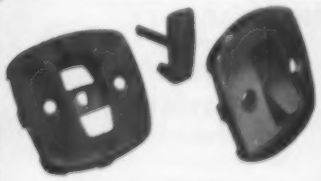
These photos demonstrate how little secondary machining is required on typical Titan pressure die castings. In each case a part as cast and trimmed only, and the same part machined are shown.

Flywheel for garbage disposal unit

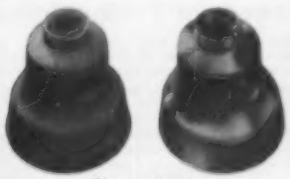
Small brush holder



Large brush holder with broached holes held to close tolerance



Overflow plate and trip handle



Shower head

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• MARVEL Syncline Filters
• NORTH AMERICAN Blower
• SQUARE-D Electrical Controls
• VICKERS Hydraulic System
and other high grade and nationally known brands.



blocks, when the die blocks are separated at the ejection cycle.

At any given instant therefore, there will be a quantitatively greater amount of absorbed heat in such thickened-up die elements. Thus, the more remote cavity regions around area *M* may attain a higher temperature by a simple process of transfer of heat from the hotter regions. This will occur despite the unavoidable losses of heat from the surfaces of the block by radiation.

A fuller understanding of the thermal conditions and heat control facilities accorded by this method of using die blocks of substantial mass, will be derived from the diagram at Figure 1b. This shows a die construction employing considerably thicker, more massive *solid* die blocks *A* and *B* than with the preceding example. As before this die is designed to produce a plate-like casting of extensive surface area but exceptionally thin wall section, a casting identical with *X* shown at Figure 1a.

Matching cavity formations *C* whose depth equals half the wall thickness of the casting are cut into the parting-joint surface of each block as before. Sprue/runner, core and ejector lay-outs are also exactly the same as in the previous case just considered.

With die blocks of so much more substantial mass, a considerable amount of heat can accumulate by direct absorption around the sprue region at each successive injection 'shot'. There will be much less dissipation of heat from the exposed external surfaces of the die blocks to the atmosphere. Such losses as do arise from this cause will occur at a much *slower* rate than in a die having unduly thin blocks.

Accumulated heat at the sprue region can thus more readily diffuse through these more massive elements in a direction towards the extreme upper end of the cavity. These latter portions thereby become well heated *before* an equilibrium is reached between heat input and the surface radiation-losses. Temperature disparities occurring over the various portions of the extensive cavity region are thus much less pronounced. It will therefore, be much easier, other factors being equal, for the die casting engineer to attain a correct working temperature over all essential

parts of the die and to maintain that temperature more easily to a uniform scale.

It will be appreciated of course that a practical difficulty arises with adoption of such a die construction. This relates to the determination of the precise degree of metal mass—or thickness of block—to be employed to meet particular heat-input conditions. Unfortunately, this cannot be determined on a theoretical basis, and much more reliable results will be obtained by conducting a series of practical tests on the die. There is a limit to the thickness — or massiveness — of die blocks which can be employed in a die to reproduce any given size or shape of die cast article.

Unless strict and accurate heat-control is exercised over such heavily-massed block constructions, with certain classes of dies there is frequently a marked tendency for heat to accumulate heavily or too rapidly around the sprue and adjacent gated end of the cavity. This condition is most prone to occur with massive dies where there is an exceedingly high heat-input coupled with an unduly low heat-loss by normal dissipation or radiation to the atmosphere. Typical examples of this kind of die are:—

(1) Dies operated to a particularly rapid injection cycle, or where the latter can be maintained at swift repetitive speeds throughout long continuous production runs.

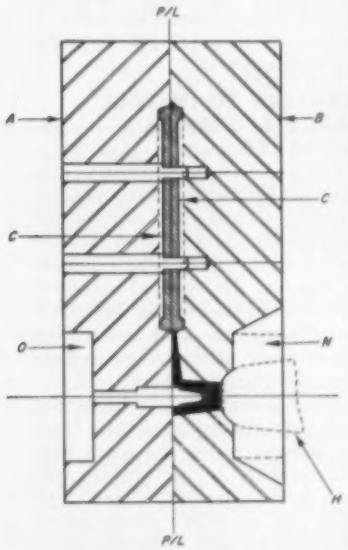
(2) Dies having an ejection cycle of a very short duration, or where, for any other reason, the dwells in-between injection 'shots' are extremely short, few in number, and regular in their occurrence.

(3) Where the operation features do not ensure close control over the temperature of the molten alloy charges successively injected into the die.

(4) Dies of the multiple—cavity impression type entailing the use of an intricate runner lay-out which latter results in the concentration of an unduly large volume of hot alloy close to the sprue-channel mouth and the gated end of the cavity.

This tendency towards overheating may, however, often be satisfactorily arrested by modifying the thickness of one or both die blocks in the simple manner illustrated in the diagram at

*Continued on page 112*




**2. TO AVOID OVERHEATING,** this die has been chambered to reduce metal mass in the affected regions (N) and (O).


**die casters...**
**designers...**
**engineers...**

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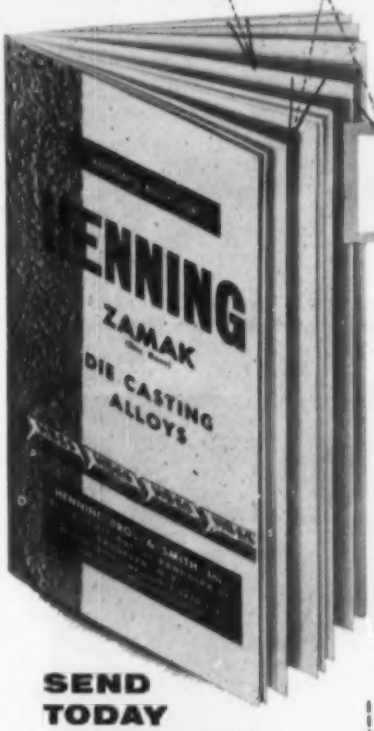


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# NEWS OF INDUSTRY & ASSOCIATIONS

*activities of people, companies & groups in the precision metal molding industries*

## AIM VACUUM MELTING SESSION TOWARD PRODUCERS AND USERS

"Vacuum melting may well provide the answer to the question of how design engineers can obtain superior metal components to withstand the stress and strain of modern applications."

So says Dr. Jack Keverian, manager of Applied Research and Development for the Foundry Department of the General Electric Company, who will chairman the forthcoming Symposium on Vacuum Melting and Casting sponsored by the Investment Casting Institute. The one-day program will be held on November 16th at the Sheraton-Cadillac Hotel, Detroit, as part of the Institute's Fourth Annual Meeting.

"This Symposium", Keverian stated, will serve a direct need in focusing attention upon the general area of vacuum melted cast materials since there is presently a major impetus toward the use of these materials because of the demand for high strength castings to operate at higher temperatures. In addition to high temperature operating components, there is a definite growing need for high strength/weight ratio applications demanding both high strength and property uniformity.

"For example, the future design for aircraft and other high temperature applications compel the metallurgist and engineer to find new ways to produce metal components to meet these needs. Vacuum melting may well provide the answer to this problem."

The Symposium is open to both members and non-members of the Institute interested in the potentialities of vacuum melting and casting.

## W. J. DURING LEAVES PRECISION CASTINGS

Resignation of William J. During as president of Precision Castings Co., Division of Harsco Corp., has been announced. Mr. During's resignation terminates 33 years service to the company, which has 10 die casting plants located throughout the country.

At the same time, resignation of his son, William J. During, Jr., as secretary of the company, was also announced. Mr. During Sr. retains his position as director of Harsco Corp. He is currently serving in his third term as president of the American Die Casting Institute.

**TESTIMONIAL RESOLUTION** is presented to Robert L. Ziegfield, right, by B. T. duPont, general manager of Plastic Metals Div. of National-U. S. Radiator in honor of nine years service to the Metal Powder Association. Mr. Ziegfield served as secretary-treasurer of MPA until it became an independent trade association last July. Mr. duPont is a former president and founding member of the association.

## APPOINTED TO STAFF

The appointment of Richard E. Kellers to the national headquarters staff has been announced by the American Die Casting Institute. Mr. Kellers, who comes to the A.D.C.I. from the Market Development Division of The New Jersey Zinc Company, has taken up his new duties at the Institute headquarters, 366 Madison Avenue, New York 17, N. Y.

For many years Mr. Kellers has been responsible for much of the advertising and sales promotion of zinc die castings at New Jersey

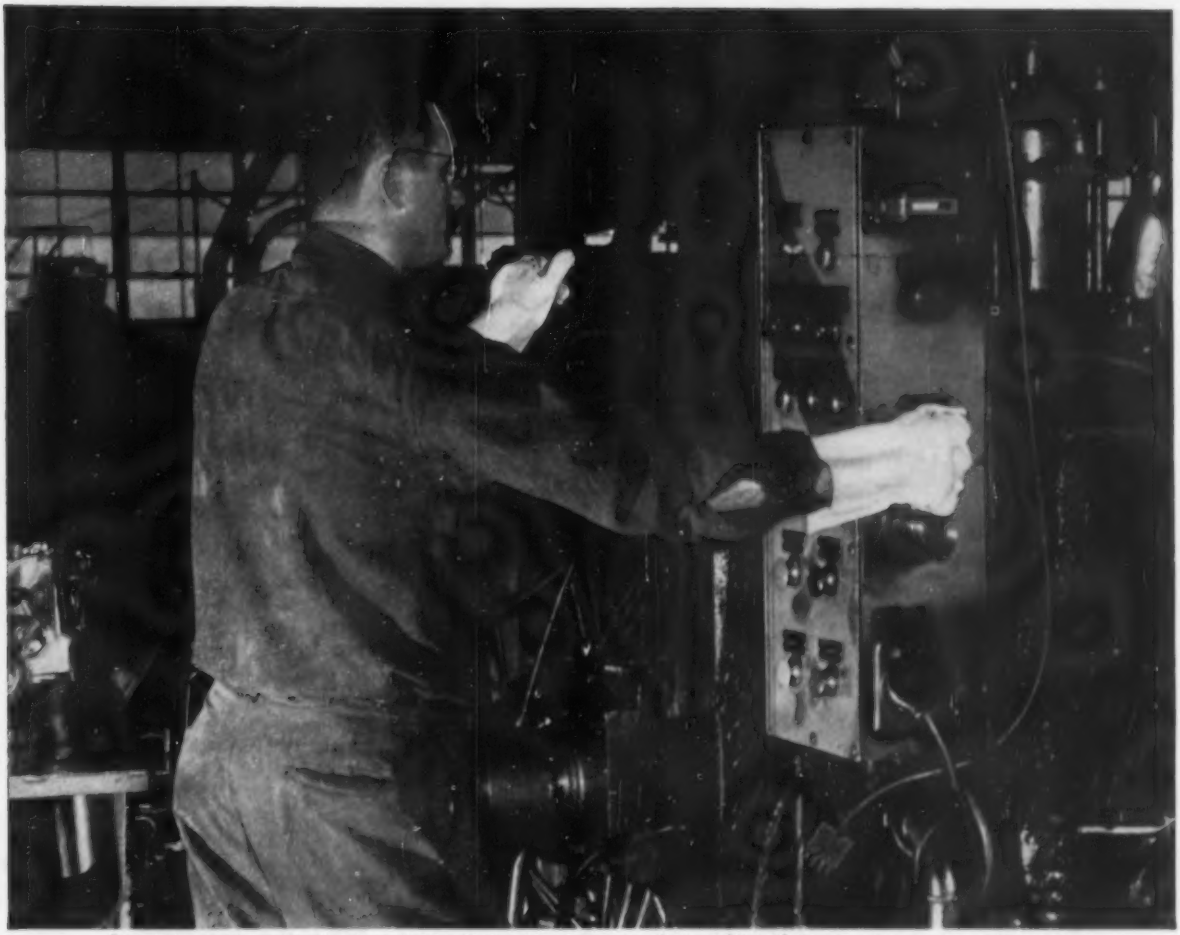
Richard E. Kellers

Zinc. This background will be fully utilized in his new position since, among other assignments, Mr. Kellers will conduct the public relations activities for A.D.C.I. in behalf of its 112 job shop die casting members.

## LINDBERG TO INSTALL LARGE ALUMINUM FURNACES

Ford Motor Company has awarded Lindberg Industrial Corporation, Chicago, the contract for 14 gigantic field-erected aluminum reverberatory type furnaces to handle the annual contemplated requirements of 64,000,000 lbs. of aluminum at the new Ford permanent mold and die casting plant at Sheffield, Ala.

These furnaces are so large that they require construction from the ground up at the plant site. The majority of the furnaces will each have a holding capacity of 65,000 lbs. of molten aluminum as received in special mobile carriers from the nearby Reynolds primary metal plant. The common practice of melting pigs of aluminum is thereby avoided.



Die-casting machine at Doehler-Jarvis Division, National Lead Co., using Cr-Mo-V (High V) die to produce sewing machine part.

# You'll get long production runs with Cr-Mo-V (High V)

Whether you are using lead, aluminum or magnesium in your die-casting work, you can be sure of long production runs when you use Cr-Mo-V (High V)—Bethlehem's 5 pct chrome-moly tool steel, with 1 pct vanadium.

Cr-Mo-V (High V) makes possible long die-casting runs because it is a high quality steel with good grain refinement, uniform center density, and freedom from porosity and weak centers. Moreover, it has the stamina to provide outstanding performance when you need it.

Here are other advantages of this fine tool steel. It makes possible dies which, after being polished to a high lustre, impart a smooth, attractive surface to the casting. Cleavage-cracking is no problem at all, provided adequate radii are used in the die, and the steel is properly heat-treated. And because of the higher carbon content, plus high vanadium, there's good resistance to surface-washing and erosion.

Cr-Mo-V (High V) is made by means of a controlled melting procedure, plus adequate forging reduction. In addition, its high quality is assured by means of ultrasonic testing. It's an easy steel to machine because it is annealed to Brinell 217 max. It also responds uniformly to heat-treatment, even in massive sections, producing a uniform hardness of Rockwell C45-47.

If you'd like to give Cr-Mo-V (High V) a workout in your own shop, or to have information about any of our other fine tool steels, just get in touch with your Bethlehem tool steel distributor.

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## BETHLEHEM TOOL STEELS

BETHLEHEM STEEL

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## STANDARD TEST BAR FOR INVESTMENT CASTING APPROVED BY INSTITUTE

Uniformity of test results throughout industry is now possible with a new cast-to-size tensile test bar for investment cast materials, recently approved by members of the Investment Casting Institute.

The ¼-in. test specimen was felt by the Institute to be the most representative and popular size for general use and was selected from among seven or more test bars known to be in use by industry.

According to R. J. Wilcox of WaiMet Alloys Co., head of the ICI technical committee, the standard test bar will enable the investment casting industry and users of its products to test on a common ground. Variables in results due to the use of different types of bars will be minimized, thus leading to a more orderly approach to development work and improvement of the product.

An added advantage pointed out by Mr. Wilcox is the possible cost saving which may result if a standard plastic pattern for the test bar is made available.

## BUY PROGRESSIVE FOUNDRY

The assets and operations of Progressive Foundry Co. have been acquired and it is now known as Progressive Foundry, Inc. Owners and operators of the new organization are Philip G. Smith, president; Harold W. Schroeder, vice president and general manager; and Jack Bean, vice president, secretary, and treasurer.

## ARWOOD PRECISION ADDS FINISHING SERVICE

Arwood Precision Casting Corp. of New York, N. Y., industrial investment casting firm, has extended its production facilities to include finish-machining of both ferrous and non-ferrous castings to customer specifications.

All Arwood plants at Brooklyn, N. Y., Groton, Conn., Tilton, N. H. and Los Angeles, Calif. have been enlarged and are now fully equipped to accept orders for finish-machined castings, it was announced by William O. Sweeny, vice-president - sales. Price and delivery quotations will hereafter be made on both unfinished castings and finish-machined parts.

## SET M.P.A. MEETING

The Thirteenth Annual Meeting and 1957 Metal Powder Show sponsored by the Metal Powder Association, 130 West 42 St., New York 36, N.Y., will take place at the Drake Hotel, Chicago, Ill., April 30-May 1, 1957. The theme of the meeting will be "New Horizons in Powder Metallurgy."

## JOINS OSWEGO CASTINGS

Robert V. Grodkowski has joined Oswego Castings Corp. as a die cast engineer, according to Frank Kidney, vice president and general manager. Oswego Castings is a subsidiary of Oberdorfer Foundries, Inc., and specializes in permanent mold and die casting.

## NAMES TWO DIRECTORS

The directors of Arwood Precision Casting Corp. of 321 West 44th Street, New York, N. Y., have elected two well-known metallurgists and business executives to membership on the Board: William O. Sweeny of Chappaqua, N. Y. and Walter P. Jacob of Waterbury, Conn.


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## INJECTORS

*continued from page 55*

dictated almost entirely by costs — costs, that is, of the completely finished components.

Designs are such that the castings will not have to be either pressure or vacuum tight; while some systems may operate at pressures (on the fuel systems) as high as 300 psi, these high pressures will be handled by parts machined from wrought metals.

The total weight of die cast metal in these systems will probably be as much or more than is now used in carburetor systems, assuming the replacement of parts in the same metal.

**WHO WILL MAKE THEM?** At the present time, all of the automobile manufacturing companies and all of the carburetor companies are actively working on or investigating fuel injection. Companies known to have systems ready or nearly ready for use are: Rochester Products Div., General Motors Corp.; Marvel-Schebler Products Div., Borg-Warner Corp.; American Bosch Corp.; Thompson Products Co.; Continental Motors Corp.; Carter Carburetor Corp.; Holley Carburetor Corp.; Bendix Corp.; and Saaty Fuel Injector Corp.

Two European systems are also known to be receiving active investigation; the English Lucas system and the continental Daimler-Benz system.

Of the different systems being investigated or worked on, all are direct port injection except the Saaty injector, designed for the replacement market, and one system being developed by Carter Carburetor which will presumably be for the replacement market. Both of these latter systems are manifold injectors which will use existing manifolds to carry the fuel-air mixture.


# Indian Rope Trick

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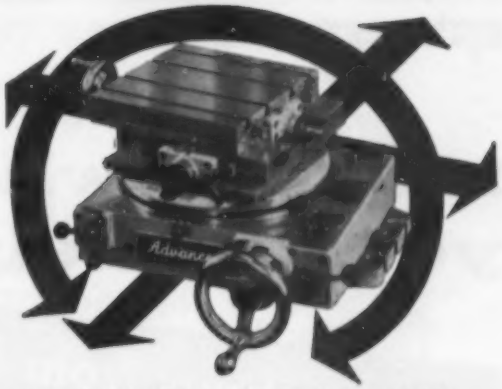

## ADVANCE CROSS-SLIDE ROTARY TABLE

Permits fast precise positioning of work-piece from ONE SET-UP. No unclamping and reclamping on your standard vertical mill equipped with ADVANCE Cross-Slide Rotary Table. Only your milling machine's table movement limits the size radius you can cut.

*Ideal for tools, dies, jigs, fixtures, gauges, patterns, molds, cams, templates, models and experimental work.*

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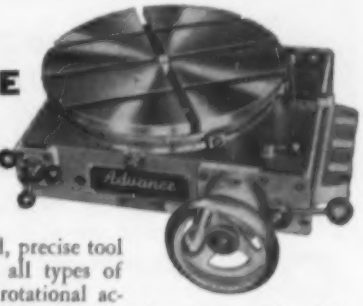

This rugged, precise tool is designed for all types of work requiring rotational accuracy. Its maximum speed and precision and minimum maintenance fills the need for a precision unit at a moderate price.

The best quality of materials and workmanship, combined with high accuracy, provide the user with a top quality precision tool.

**Full Details on Request**

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Figure 2. This modification comprises *reducing* the metal mass in the affected region by chambering out the rear side of the stationary die block *B* lying adjacent to the injection nozzle *H*, to produce the substantial conical recess *N*. The latter may well be made circular to simplify machining, and is formed central with the sprue channel in the block. Its diameter is considerably greater than the injection nozzle so it may easily seat on the die block.

The recess diameter is also determined carefully so that a portion of the recess spans the critical gated end and runner portion of the cavity lay-out, as shown. For preference the sides of recess *N* should be tapered in the manner indicated to promote best distribution of heat to the remoter portions of the block. The depth of recess *N*, ie, the amount of metal to be removed to ensure best heat balance, has to be ascertained during the initial proving tests on the new die.

A similar recess as at *O* will also generally be required in the rear side of the movable die block.


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*Opportunities rates: $20 for the first column-inch; $15 for each additional column-inch payable in advance. To answer box number advertisements, address responses to the box at Precision Metal Molding, 812 Huron Rd., Cleveland 15, Ohio.*

SALESMAN — POWDER METALLURGY — Leading manufacturer of powder metallurgy bearings and parts has opening for aggressive salesman. Some powder metallurgy experience preferred. State qualifications and salary required. Write Box No. 11156.

WANTED — Die casting machines for resale and rebuilding. Write Box No. 11256.

EXPERIENCED FOUNDRY SALES ENGINEERS now operating a successful sales agency for non-ferrous, ferrous and high alloy sand castings want to represent a precision foundry producing castings by the lost wax process. Western and Central New York territory. Write Box No. 11356.

FOR SALE: Lester, model HHP2, 5¢ die casting machines; Stokes model P3 (80 ton) press; Stokes model S4 (40 ton) press; Stokes model F (4 ton) tablet press; Stokes model 43A granulator; Baldwin hyd. ingot presses (75-100 ton); Porter 27" (stainless body) ball mill loaders and unloaders; Day 80 gal. blender (stainless body) Hevi-Duty; lancaster mixer (open pan type) model EB3; Hummer screens (stainless) 40 mesh; all equipment in perfect condition and priced reasonable. Write for full information. Globe Trading Company, 1815 Franklin St., Detroit 7, Mich., Phone WOodward 1-8277.

FOR SALE: One Lester HHP-3XS 600 tons, aluminum die casting machine solid frame; One Lester HP-1-C 225 tons one piece frame, new 1953. Both just overhauled and in fine condition. Magnesium Industries Inc., 1313 Kalamazoo Street, South Haven, Mich. Phone 1163.

POSITION WANTED: College graduate, age 49, presently engaged as general manager of a large die casting company in Detroit area, 15 years in same position. Wide experience in organization, planning, employee and customer relations, costs. Want to change for personal reasons. Best references. Will locate anywhere. Write Box No. 11456.

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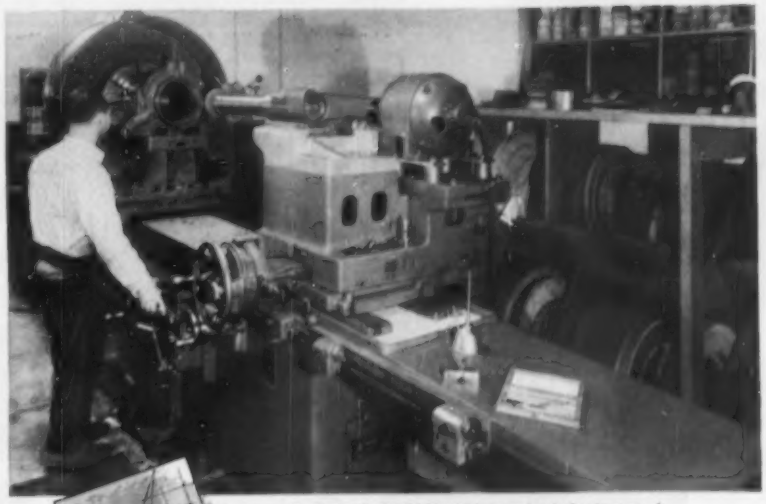

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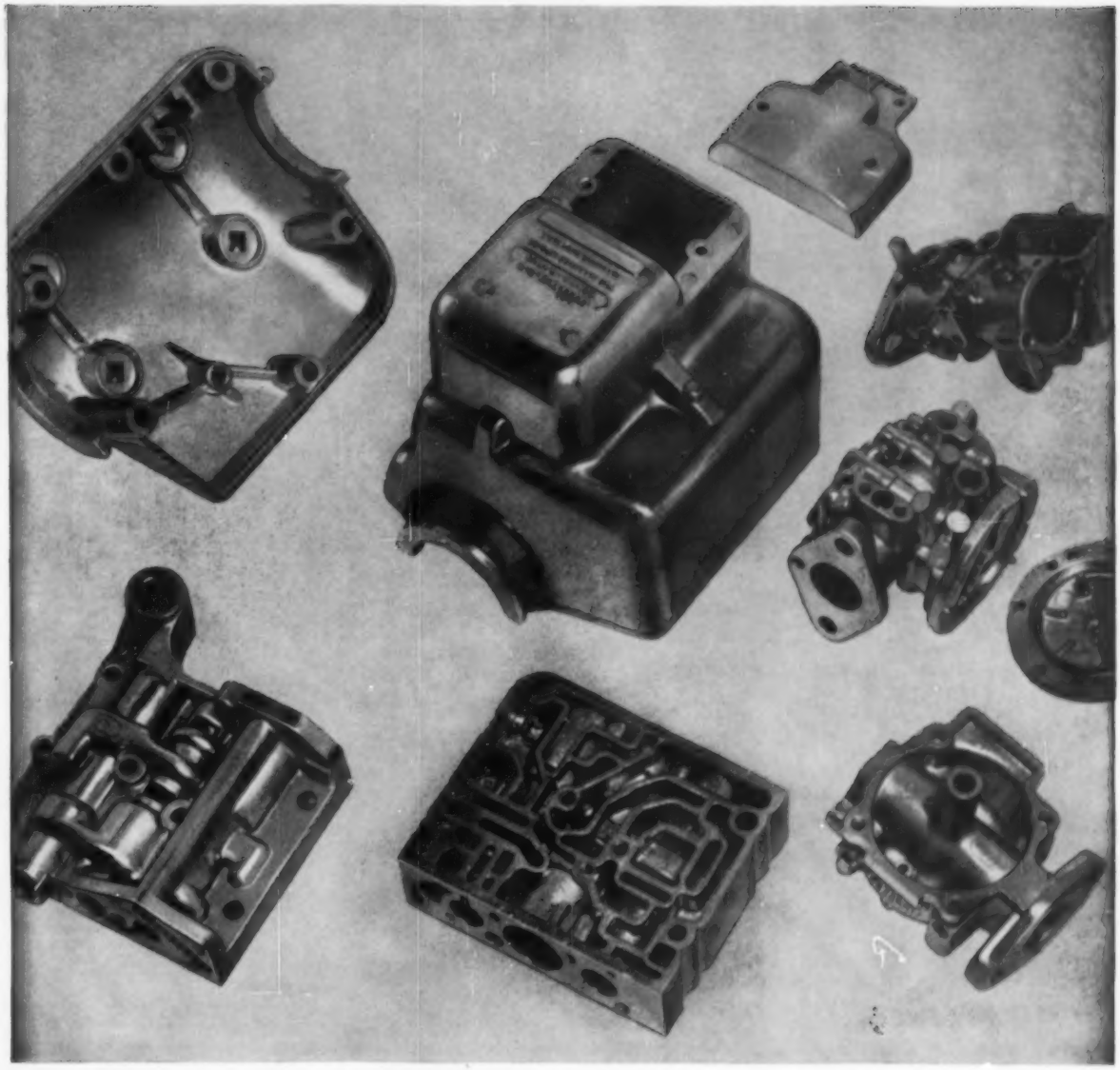

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